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ABSTRACT

Designed to give the teacher ideas for enlivening and enriching the teaching of business subjects, this publication on teaching keyboarding/typewriting is part of the Rapid Reader series. It begins by differentiating between keyboarding and typewriting and establishing the criteria for making decisions regarding appropriate content and methodology. A discussion of content in teaching focuses on determination of activities performed by employed and personal-use typists and suggests an outline for typewriting courses. Two sections then present a number of suggestions for introducing the keyboard and for improving the skill of production typists. A recommendation contrasting what should be happening in the classroom with what has traditionally taken place is followed by a brief explanation. Individualization of learning and the possible advantages and disadvantages of individualized programs are then considered. The discussion of grading examines reliability and validity of measurement instruments, the three most commonly used methods of the grading of keyboarding, evolving grades from separate speed and accuracy scores, the grading of production typewriting, and combining grades to determine a terminal performance grade. Criteria are also offered for selecting textbooks and microcomputer software. An appendix lists sources of instructional materials. (YLB)

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TEACHING KEYBOARDING/TYPEWRITING

By

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St. Paul, Minnesota

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Acknowledgments

Rapid Reader No. 3

Appreciation goes to the following people who reviewed early drafts of the manuscript: Judith Lambrecht, University of Minnesota; Scot Ober, Senior Typing Editor, Gregg Division of McGraw-Hill Book Co.; Richard Thiel and Mary Veznaian, PAR, Inc.; Leonard J. West, Baruch College of the City University of New York and typewriting author for Harcourt Brace Jovanovich, Inc.; and Kenneth Zimmer, California State University of Los Angeles and typewriting author for Glencoe Press. The draft was also sent to Jerry Robinson, South-Western Publishing Company, for review, but he declined because of potential conflict of interest with a similar project. Douglas Anderson and Mark Davison, University of Minnesota measurement professors, reviewed the section on evaluation.

The author also wishes to acknowledge the contributions made to his thinking about research and typewriting methodology by Leonard J. West, both from his writings (West, 1969, among others), and as West's student, advisee, research assistant, and colleague over many years.

The "state of the art" in typewriting research is such that many of the important methodological questions do not yet have a sufficient research base for unanimous agreement. Thus, in spite of the input provided, the author retains responsibility for the recommendations included in this Rapid Reader.

G.N.M.

Rapid Reader No. 5

I am grateful for the response given to the first edition of this Rapid Reader written over six years ago. I am pleased with the increasing interest given to research in typewriting, by psychologists as well as business educators, and to keyboarding itself in this time period. There is still much research to be done. I look forward to continuing impetus for keyboarding/typewriting research from Delta Pi Epsilon, both in its foundation work and in providing an outlet for publication of such research in the Journal. I acknowledge the contribution of those who continue to do research in this area and to my students who have used this Rapid Reader and have been useful in providing feedback on areas needing improvement. I hope that this publication will continue to be of use to the business education profession.

G.N.M.
February 25, 1984

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Keyboarding and Typewriting: Are They the Same?

With the growing popularity of microcomputers and other devices that use a typewriter-like keyboard in homes, schools, and businesses, "keyboarding" has been used increasingly in place of "typewriting." But are they different? And if they are, how are they different? As in so many emerging concepts, there is little agreement.

Alexander & Dickey-Olson (1983, p. 4) report that some people are promoting "the idea that keyboarding class is really a typing class with a new name." Beaumont (1981) differentiates between keyboarding and typing based on their purposes—the typist uses equipment on a full-time basis to produce a final product; keyboarding is used as a tool incidental to the person's primary responsibility. McLean (1984a, p. 1) has concluded that "simply, keyboarding is using a keyboard, as found on a typewriter or microcomputer, to input information... Keyboarding does not usually refer to the manipulation of that information, though, obviously, a keyboarding skill is of little value unless there is an application for its use."

For consistency, "keyboarding" will be used throughout this Rapid Reader to refer to keystroking when no decision-making beyond key selection is involved; "typewriting" will be used when format and placement decisions, as well as keystroking, are involved.

A Basis for Decision-Making: How Do We Know How to Teach?

Before the appropriate content areas for instruction or the methodologies to be used in a classroom can be suggested, the criteria for making such decisions need to be established. Content and methodology have often been based on what the available instructional materials do or on how teachers were taught or on suggestions offered in professional periodicals, at conventions, or informally. Are these sufficient or the most effective means of disseminating information about instructional practices? Perhaps not. The author's review of research in keyboarding and typewriting suggests that considerable research is yet needed in areas of great importance to typewriting methodology and content. The author, therefore, has reviewed research in other psychomotor areas, as well as in typewriting, for its implications for typewriting instruction.

In addition, it is necessary to understand the model for learning on which the recommendations contained herein are built. Stimulus-response conditioning models are used to explain acquisition of psychomotor components of typewriting instruction. The Skinnerian (operant conditioning) model, relying on reinforcement, is used in the early stages of keyboarding, while

the Pavlovian (classical conditioning) model, relying on close association between stimulus and response, takes over at higher stroking skills. While the use of these models in the cognitive and affective domains of learning has been criticized, they have remained well accepted for the acquisition of psychomotor skills. Indeed, other models of learning say little about psychomotor skills, though interest in research in the cognitive aspects of keyboarding skill acquisition is growing (Cooper, 1983).

Stimulus-Response

For any activity that takes place in the typewriting classroom, a stimulus must be provided for students. Typically, in the beginning stages of keyboard learning, the teacher will call out a letter, such as "f," to which the learner "emits" a stroking response. At later stages of learning, when production typewriting is undertaken, a teacher might provide a handwritten, one-page letter (the stimulus) with the instruction that students type a mailable letter (the desired response).

Association

Obviously, for the desired learning to take place, the response made must be the desired response. The desired learning does not take place if, when an "f" stimulus appears, the student sometimes responds with a "g." Thus, what is needed is some means of tying together the given stimulus with the desired response. When this happens on a consistent basis, then the desired response is associated with the given stimulus, or, in Skinnerian terms, conditioning is taking place. The activities that the teacher uses in the classroom must encourage the development of associations between stimuli and responses.

This association is frequently violated by the use of the Expert's Drill, in which the students key "a;sldkfjdksla;." Such a drill, while perhaps effective in the first day or two of instruction when students are learning correct keyboarding techniques, loses its effectiveness beyond that point. When students strike the "a," they are not associating that stroke or response with the stimulus "a." Rather, they are simply stroking a memorized pattern that can be executed without conscious attention to the names of the keys struck. To use the drill to "loosen up finger muscles" falsely assumes the need for warmup.

Knowledge of Results

Knowledge of results (KR) provides four possible functions: reinforcement, correction, direction, and motivation. According to the Skinnerian model, KR is necessary for the stimulus-response association to develop. In short, students must know when they have made a correct response to increase the probability that that response will be repeated consistently in the future. Likewise, students need corrective knowledge when an incorrect response is provided. Unless the students know that the response provided

was incorrect, they have no way of knowing that they need to alter their responses for the future. Envision blind students learning how to key. If they sat at the keyboard and were forced to make responses to audio stimuli without any knowledge of whether or not they had hit the correct key, they would never learn how to key. Thus, when working with blind students, it is necessary to use some technique to provide this feedback, such as standing behind them, to indicate when the correct or incorrect keys have been struck; otherwise, the students would never learn the appropriate responses.

What kind of feedback is needed? The author participated in a research study similar to those conducted by E. L. Thorndike more than fifty years ago. The author was directed to place his hand in a hole in a box and draw a line on a sheet of paper, stopping at a line printed on the paper. Ten trials were made with no feedback provided, and "success" did not result. The next ten trials provided feedback of "too high" or "too low." Before the ten trials were up, the line could be met consistently. In the third set of ten trials, the feedback was explicit. "Three inches too high," "Half inch too low," etc. By the third attempt the line was met consistently. These results were obtained throughout the experiment. The conclusion of many such studies is that general directional feedback is better than no feedback, and that explicit directional feedback is better than general directional feedback, especially in early stages of learning.

Temporal Contiguity

Temporal contiguity (closeness in time) is useful for increasing the efficiency of learning. This principle states that the closer together the stimulus and response come to one another, the faster learning takes place. Thus, in the beginning stages of learning the keyboard, one must ask the question: How can students most quickly respond to a given stimulus after having perceived it? It does not occur using the intermediate step of looking at a keyboard chart. The fastest way for beginners to locate a key after the stimulus is perceived is to look at the keyboard. While this recommendation may disturb some teachers, this Rapid Reader will suggest ways in which students can use visual access to the keyboard and how they can be weaned from that behavior if they develop overreliance on such visual access.

In addition, temporal contiguity is required between the response and the reinforcement. In fact, research in psychomotor areas suggests that, if anything occurs between the time a response is given and the time that the response is reinforced, then the reinforcement is weakened. For example, students in early lessons may use a 50-space line. The teacher has directed students to keep their eyes off the keyboard, monitor, or typescript. Assuming that students are conscientious and follow these directions, they then get no opportunity for reinforcement until they have completed that line. In addition, as will be discussed in the section on kinesthesis later, beginners are unable to "feel" keyboarding errors when made. Let's assume that by the end of day one students are typing 10 gwpm. Then, if they make a key-

boarding error on the second stroke, they will wait almost a full minute before getting any knowledge of results; and, in addition, 48 responses will have occurred between the time of the second and last response on that line. The contiguity principle states that, if even one response intervenes, the reinforcement is weakened. Imagine the impact of 48 intervening strokes or responses! This is another reason for not prohibiting students in beginning stages from watching their typescript or monitor when necessary to receive reinforcement. If a misstroke is perceived **immediately**, the typist may remember the incorrect movement, thus receiving corrective information.

Temporal contiguity is also necessary for production typewriting. Typewriting teachers must not be stationed at the front of the classroom, but they must be constantly on the move up and down the aisles so that students can be given corrective feedback. The teacher can readily point to a student's work and say, "You forgot to include today's date," or, "You forgot to use a 50-space line on a short letter." Students will then know immediately that they have made a mistake They will remember better the process they went through in making those decisions and take corrective action.

Finally, the principle of temporal contiguity suggests that the stereotype of the conscientious typing teacher going home at night with a bundle of papers under each arm to be graded needs to be called into question. Even a conscientious teacher frequently will not get those papers back the next day, but it may be two or three days before the papers are returned to students. Even if the teacher is successful in getting the papers back to the students the next day, contiguity has been violated. Thus, the teacher is better off using techniques that will permit continuous reinforcement during the class period. Additional methods of providing immediate reinforcement (knowledge of results) to students in production typewriting would include typing the problem in perfect format for duplication, projecting a master on an overhead transparency for all students to see once they have completed their work, making the transparency available to students at their desks so that they can put the transparency over their own project to see where their problem may deviate from that of the model, or giving students access to the teacher's key. Each of these approaches underscores the importance of using all elite or all pica print in a classroom—otherwise, two models of each problem are required.

Mediation

At the start of learning, many activities intervene between perceiving the stimulus and making the response. Those activities are called mediators. When students are prevented from looking at the keyboard, they must use processes such as vocalizing, looking at keyboard charts, and using cognitive processes, before the response can be made. The fewer the mediators that exist, obviously, the greater the temporal contiguity between stimulus and response, and the more efficient the learning.

One mediator that exists throughout early learning, regardless of the teaching techniques used, is vocalization—whether the letter or word is actually whispered or only mentally sounded out. Vocalization begins to disappear when students reach perhaps 15-20 gwpm. At this stage, keyboarding follows letter perception rather quickly, without intervening vocalization of the letter. At still later stages, students begin to chain their responses with 2- and 3-letter chains. A considerable overlap among these three steps continues even when a typist reaches high-level stroking skills.

Because "the" is an easy word, or combination of letters, to key (a balanced-hand word) and because it is keyed so frequently (it is the most common word keyed), it becomes automatized very quickly; that is, the word is not keyed as three individual responses but as a single response. Mediators, because they are not being reinforced (only the responses, which are closest to the reinforcers, are reinforced), drop out, until finally at high levels of performance the students respond automatically to given stimuli. Note, however, that even good typists who encounter unusual words or combinations of letters, such as in the word "xylophone," quickly drop back to stroke-by-stroke vocalization as the word is keyed.

Kinesthesis

Kinesthesis, which can be defined simply as sensations of motion and position in muscles and joints, is the basic sense required in the acquisition of psychomotor skills. To understand what kinesthesis is, close your eyes and touch the tip of your nose. Most people will be able to do this successfully. Now think about how you were able to find your nose. Go through the five traditional senses of seeing, hearing, smelling, tasting, and feeling. None of these senses was used. Instead, you have made the movement so many times from your hand to your nose that you have developed a "memory bank" that permits adequate feedback to your muscles to complete the motions needed to reach your nose.

It is this principle that enables students to make the appropriate responses at the keyboard. But kinesthetic feedback does not exist automatically in each person—it must be learned. Take, for example, the 15-month-old child who is learning to feed himself or herself with a spoon. Notice where the food lands—it seldoms hits the mouth! Yet, if you look around at your next meal, you will find that few adults miss their mouths. People have made the movement from plate to mouth so many times that it has become automatic. This principle is important to keyboarding instruction because we cannot expect students to make responses automatically until they have learned them. They need to make the motions many times before they become automatic. That is why students, regardless of the directions given to them, cannot key without having visual access to the monitor, keyboard, or typescript during initial stages of learning. By prohibiting visual access, we are asking students to perform in a manner that is not possible even for expert typists. West (1968a), for example, found in his study of vision and

kinesthesis that the performance of even the most expert typists, those keying up to 108 wpm, was dramatically affected when visual access to the keyboard and typescript was removed. A premature emphasis on non-visual keying only creates anxiety and tension on the part of students.

Another important factor to recognize about kinesthetic ability is that it is not equally distributed among the population. Just as persons differ in visual and auditory acuity, they also differ in kinesthetic sensitivity. Note, for example, the various kinds of kinesthetic skills that are necessary for performance in athletics. On a football team not all people respond the same way under the same conditions. Some people are expert field goal kickers, others are expert passers, some are expert runners—all use different kinds of kinesthetic skills. We should expect the same kind of differences in the keyboarding classroom. Indeed, the fact that kinesthesis is unevenly distributed in the population is one explanation why individual differences develop so rapidly in the keyboarding classroom. It is common to have a range of 5 to about 25 wpm among true beginners after the first day of instruction. Such a range so early in the course requires individualization of objectives and instructions from the beginning. Indeed, some students may be so deficient in kinesthesis, among other factors, that it might not be efficient for some few students to take the time they will need to acquire such skills.

Differentiation and Generalization

A major concern among typewriting teachers is the development of keyboarding accuracy. While this subject receives considerable discussion later in this Rapid Reader, for now it is sufficient to say that generalization of response (i.e., providing similar, but different, responses to the same stimulus) is one of the major causes of inaccuracy among typewriting students. Think about some of the common substitution errors, such as "t" for "r," and vice versa. The student must be able to differentiate the response "r" from the response "t." What makes this task so difficult is that the keys are adjacent and the angle and distance of finger motion only slightly different. Likewise, the substitution of a left-hand letter ("e") for a right-hand letter ("i") is also common. Thus, students who generalize responses tend to make errors that are not found when students are able to differentiate. Drills that can be used to develop this differentiation will be presented later in the section on teaching the keyboard.

Generalization is also desirable on occasion. Stimulus generalization (i.e., perceiving similar, but not identical, stimuli to be alike) is needed when students are typing letters which may be handwritten, printed, or a combination of the two. Response generalization (requiring similar, but not identical, responses to identical stimuli) may be needed when typing a letter on a magnetic or lift-off typewriter (requiring strikeovers) as compared with typing that same letter on a standard typewriter (where erasures or corrections are needed).

Motivation

Motivation is a crucial component of all instruction, including typewriting. However, it is necessary to understand what is involved in motivation in order to use it effectively. Motivation is not a single activity that can be predetermined in a classroom but should result from **all** of the activities that are used within the classroom.

The following conclusions about motivation result from a review of research in motor skills:

1. Encouraging comments are better than discouraging remarks, and poor performers are more likely to be adversely affected by discouraging remarks than are relatively proficient subjects.
2. Verbal praise may lose its motivating power if repeated so many times that the receiver loses confidence in the sincerity of the praise.
3. Material reward is more effective than verbal but may lead to dependence, with the reward becoming more important than the performance. This conclusion may be more relevant to teachers working with children than to those working with adolescents or adults.
4. Competition is a very effective motivator. Competition with one's self is best, followed by competition with others of comparable ability (homogeneous grouping) and competition by groups (e.g., one class versus another, one row versus another, etc.). Thus, an activity in the keyboarding classroom which pits individuals against one another is not an especially effective motivational technique. Consider, for example, the common practice of including on a bulletin board a list of student performance, student by student. Joe may be recorded with a 60 wpm timed writing, while Mary is recorded with a 20 wpm timed writing. Not only is there potential for Mary to be held up to classroom ridicule (the use of codes in place of names does not fool students, either), but, in addition, she also has not been motivated because she knows she cannot catch up with Joe. While both students need motivation, it is apparent that Mary at 20 wpm needs considerably more assistance in meeting either vocational or personal use goals than does Joe at 60 wpm. Besides, any public display of student performance may violate the law by invading student privacy. A much better technique would be for students to keep individual charts at their desks or to use computer software that records such information so that their competition is with themselves from day to day rather than with others of unequal ability. Teachers may also view the charts so that improvement or lack of it can be noted.
5. While punishment (verbal, physical, or denial) can be effective in controlling behavior, results are very complex and vary widely from student to student. The unpredictability of the effects of punishment suggests the use of reward in preference to punishment.

6. The greater the variety of incentives, the greater the improvement in performance. Students may be motivated in different ways at different points in time. Thus, the teacher needs to be constantly aware of using as many types of motivation as possible for the students.
7. Participation in goal setting leads to better performance and may be one of the best approaches to use because motivation is internalized.
8. Immediate goals are preferred over remote ones (i.e., principle of contiguity). Thus, grades (occurring at the end of the year), bulletin boards (which may promote employability two years in the future), and so on are weak motivators. In addition, bulletin boards, when left for several days at a time, lose their effectiveness.
9. Reinforcement (feedback or knowledge of results) lets students know where they stand and rewards them for accomplishment, while at the same time it lets them know what needs to be done to accomplish their objectives.
10. Students need to experience success, but success should not be too easily attained. Too easily attained success loses motivational power. The objective of this Rapid Reader is to provide teachers with techniques that will permit their students to have success in typewriting and thus be motivated for further success and growth.
11. Perhaps the best motivator of all may be the worth that a teacher instills within each student. Positive personal contact between teacher and student creates an environment in which each student can perform at peak level.

Guidance and Confirmation

Guidance techniques provide students with a model of the problem to be completed and explicit instructions on how to proceed. Confirmation techniques permit students to complete projects without models or explicit directions. Only when the project is complete are students given a model to determine whether they have typed it correctly. The applicable principle in learning is that guidance is necessary in the beginning stages of instruction but should quickly give way to confirmation techniques. Thus, the typical practice in typewriting textbooks of indicating to students, even after many months of typewriting instruction, the number of words in each letter (in parentheses at the bottom of the letter) and notations to include the date or to use a 60-space line are inappropriate. Is such assistance available to students in the real world as they use their typewriting skills? Can you imagine an employer saying, "John, will you please type this 213-word letter, be sure to use a 60-space line, and don't forget to include the date and reference initials"? Yet, some textbooks continue to provide such guidance for students long after it should be needed by them.

One must also ask the question, where do students learn decision-making techniques? How do they ever learn to estimate the number of words in the

letter, to determine the need for enclosure or carbon copy notations, or to decide on letter style, etc., if these decisions are always made for them? When McLean (1971) presented rough draft material to 3,700 students, it was not unusual for students to come to the test administrator begging to be given directions for typing the tasks. More than one student was in tears because such directions were not provided. Manuscripts were turned in perfectly typed—with crossed out words and handwritten corrections so that the completed project was identical to the copy given to the students. Why does this happen? Because the students had not been put in a position often enough where they had made decisions about how to type material in their classroom.

Transfer of Learning

The goal of typewriting instruction is to permit the student to use what is learned in the classroom in a real-life setting. Typically, the two major objectives of typewriting instruction are vocational and personal use applications. By providing stimuli in the classroom that are identical to the stimuli encountered later, transfer of learning is maximized. If the stimuli are changed, transfer will still occur as long as the response required is the same as that required in the real world. However, the transfer is not as great as it would have been had the same stimuli been used.

The major implication of the principle of transfer is to the kind of material that students type from and the kind of equipment that is provided for them to type on. Considering the first question, surveys (see Erickson, 1971; Guffey & Erickson, 1981; Ober, 1974; & Perkins, et al., 1968, among others) have routinely shown that more than half of the real-world copy is either handwritten copy or typed material with handwritten corrections. By combining these two categories, it is apparent that somewhere between 50 to 70 percent of all material presented to the typist comes to the typist in this format. This type of stimulus is followed, in order, by shorthand and machine dictation, with some small percentages of composition, typed copy, dictation at the typewriter, and so on. For personal-use application (Featheringham, 1965), approximately 85 percent of everything that is typed is from handwritten copy, followed by 15 percent composed. What these references indicate is that, except for one study which found 15 percent, almost nothing is typed for either personal or vocational use from perfectly printed copy. Yet in most available textbooks by far the largest percentage of all typing done is from perfectly printed copy. In fact, while increasing, only a small amount of material is provided for typing from handwritten copy. Economics, of course, is a major reason for this—the addition of lots of longhand could double the length and cost of the textbooks. Suggestions will be made later as to how this situation can be remedied using existing textbooks.

One must also ask what kind of typewriter students should be using in the classroom in order to maximize transfer. Standard and Poor (19[illegible]6, 1980,

1982) conduct occasional surveys to determine sales and installations of office equipment. They found that the number of typewriters in offices fell from 9.5 million in 1976 to 6 million in 1982, with IBM's (primarily single element) accounting for the largest portion. They are quiet about the existence of the manual typewriter, suggesting that it is no longer a factor in the business world. The 1982 survey highlighted the rapid growth in sales of electronic typewriters, projecting a growth of 437 percent from 1981 to 1986. Guffey & Erickson's (1981) findings of the frequency of use of liftoff and electronic correction confirm the widespread use of "correctibles" and electronics.

The sale of microcomputers was projected in 1982 to continue growing at a rate of 40 percent in home markets and 50 percent in business markets. Schatz (1983) reported September 1983 statistics compiled by Market Data Retrieval (MDR) as to the extent to which schools have acquired computers: 62.4 percent of elementary schools, 80.5 percent of junior high schools, and 86.1 percent of high schools had computers. While IBM has made rapid inroads into the business sector, MDR reported that the make of microcomputers used for educational purposes in schools was as follows: Apple, 49.4 percent; Radio Shack, 21.0 percent; Commodore, 15.2 percent; Atari, 2.9 percent; IBM, 2.7 percent, and Texas Instruments, 2.0 percent.

The movement toward microcomputers has also made more feasible the movement toward alternative keyboards. For example, the Apple IIc provides an easy, pushbutton adjustment to change the keyboard from the standard to the Dvorak keyboard. It has long been known that the standard keyboard (also known as QWERTY) contains inefficient letter layout, but the difficulty of converting equipment and typists has precluded the wide use of the Dvorak and other simplified keyboards. With considerably greater proven efficiency and the ease of converting equipment, it is anticipated that there will be increasingly wider use made of such keyboards.

Minicomputer sales are projected to grow at an annual rate of 20 percent, with word processor growth projected at 20-30 percent annually through 1986, though the trend is away from standalone systems to shared systems. Walshe (1981) estimates that there is one word processor for each typewriter in the office and projects that this will be four to one by 1985. West (1983, p. 287) concludes: "The former universality of conventional typewriters no longer obtains, and their use is likely to drop at an accelerating rate hereafter."

Now consider portable typewriters. Through 1976 the sales of portable typewriters accounted for approximately 60 percent of the domestic sales of typewriters. The ratio of electric portables to manual portables in 1976 was about 3 to 1. The 1980 report forecasted a "flat demand for portables." In the 1982 report portables are not mentioned. It is possible that the rapid growth of microcomputer sales in home markets and the increasing availability of "rebuilt standards" (because of the rapid growth of word

processors and electronic typewriters) will continue to have a detrimental effect on the sale of portable typewriters. On the other hand, as portables become available with electronic and editing capabilities, this trend could be reversed.

If we are interested in transfer of learning, the implications from these surveys seem apparent. Some form of electric or electronic keyboard is likely to be used most often by our students. If students are going to maximize their transfer of learning from the classroom, then they should be learning on electric typewriters or microcomputers. (Only where local conditions are **known** to be markedly different from these should different decisions be made about how to equip the classroom.)

Individual Differences

Teachers have long known that every student in the classroom is unique, with no two students having exactly the same needs or abilities. This same recognition is needed in the typewriting classroom. Comment has already been made on the differences in the way in which kinesthesis is distributed among students. In advanced production typewriting tasks, as decision-making plays more and more of a role in the performance of such tasks, intelligence becomes very important, in contrast to keyboarding skills, which are almost independent of intelligence. Thus, individual differences increase because of the unequal distribution of intelligence in the population.

In any instruction we need to take into account the individual differences of our students. We cannot use techniques that assume that all students need the same kind of instructional methodology, will respond at the same rate, or need the same practice focus. This principle will be illustrated in greater detail in sections on instruction on the keyboard and in production typewriting, as well as in the section on meeting the needs of individual students.

Massed Versus Spaced Practice

One way of viewing massed practice involves a considerable amount of instruction given on one unit before moving to a second unit. With spaced practice, additional activities are encouraged between repetitions of practice on one unit of instruction.

While the evidence is somewhat inconclusive (Schmidt, 1975; Hamod, 1972), it would appear that massed practice is necessary during beginning stages of instruction, followed by spaced practice at later stages. This might mean, for example, that students spend one week on instruction in letters before they move to instruction in manuscripts. At later stages, however, it is important for them to come back and type earlier kinds of activities but perhaps on a less concentrated basis. In terms of keyboard development, massed practice means that students should not move willy-nilly from speed practice to accuracy practice but should spend enough time at speed practice to develop sufficient gains before moving to accuracy practice (Kamnetz,

1955). Such speed gains provide a sufficient cushion "against which a deliberate slight slowdown during accuracy practice will still leave a net gain in speed after errors are reduced" (West, 1977b).

Learning Curves and Learning Plateaus

If student performance in keyboarding were graphed, speed would increase rapidly at the beginning and gradually level off. Errors, on the other hand, begin high, show rapid initial improvements, and then begin to level off at about 2 errors per minute (epm). This rate will slowly decrease over time but is unlikely to go below 1 epm for any heterogeneous group of typists. One reason for rapid initial improvement is that students have so many ways in which to make improvement that improvement comes very quickly. As students become more skilled, however, there are fewer ways to improve; thus, continued growth takes place more slowly. This factor is a major reason, among others, for not using evaluation techniques that look at improvement rather than at absolute performance. It is much easier for a student to go from 20 to 30 wpm than it is for a student to go from 70 to 80 wpm.

Learning curves are also important to understand in terms of learning plateaus, which are defined as no overt change in performance. By using individual charts, as suggested in the section on motivation, both the students and the teacher can identify readily when a plateau is occurring over a period of time. While plateaus should be expected on errors, there is no reasonable expectation that prolonged plateaus should exist on speed, recognizing, however, that the apparent lack of growth will be longer for students at higher skill levels. Thus, when a plateau is identified, teachers need to examine instructional methodology and materials and evaluate specific student performance to identify weaknesses.

The concepts presented in this section will serve as the basis for making decisions about how to teach, what to teach, and how to evaluate students in a typewriting program.

Content in Typewriting: What Should We Teach?

The question of what to teach is dependent on the objectives of the typewriting program. In considering the two objectives for a typewriting program—vocational and personal use—it would be ideal if we could construct a course that would meet the needs of both groups of students without having to have separate curriculum offerings. In fact, this is readily possible.

Determining Activities Performed by Employed and Personal-Use Typists

A number of task analyses of activities performed by employed typists have been conducted. Particular reference was made to the Erickson (1971), Ober (1974; 1981), and Perkins, Byrd, and Roley (1968) studies as a basis

for determining vocational topics for the outline suggested below. The Featheringham (1965) study was used to determine activities of personal-use typists. In addition, a major project (Minnesota State Department of Education, 1976) was undertaken to articulate curricula between secondary and postsecondary institutions so that students could move from a secondary to a postsecondary institution without having to repeat competencies already developed in the secondary program. The participants in the project were drawn from industry with input from educators at both levels. A separate committee was formed for each of twelve cluster areas in the secretarial/clerical occupations so that separate recommendations for content were developed for legal secretary, medical secretary, secretary without shorthand, secretary with shorthand, office services aide, etc.

To develop the outline included later in this section, all of the typewriting components common to the twelve clusters were identified. These components were combined with those identified in other task analyses, and the items were listed in behavioral objective format, except that criteria were not provided. These objectives were then listed in rank order of importance as determined by the frequency of their occurrence on the job or in personal-use settings.

The outline developed operates under the assumption that most students will take no more than a one-year program in typewriting, but that some students will take a second year of typewriting or acquire additional typewriting skills in courses such as office procedures. The outline that follows does not designate semesters or quarters as many schools are moving towards individualized typewriting programs. For schools still using traditional scheduling patterns, a "segment" may be treated as a trimester (three to a school year) with one and one-half segments to a semester.

Many schools are finding it necessary to offer keyboarding during five-week summer terms. Such intensive offerings are generally taught for 1½-2 hours per day, still providing 37-50 hours of total instruction, the equivalent of the number of hours available in a trimester offering. The material contained in Segment 1 would thus be appropriate for such a course offering. The important criterion is to provide students with basic keystroking skills and at least a minimum of application skills.

Also, it is not necessary to make recommendations separately for various levels of institutions. The goal is for students to acquire competence at typewriting whether at the elementary or secondary or postsecondary level. As more postsecondary schools provide for a competency-based program, students will carry their competencies from high school into the postsecondary situation without having to be tested or repeat items already taken. In Minnesota the objective is to develop a transcript for use in secondary and postsecondary schools indicating those items on which competency has been developed and criteria for measuring and evaluating each competency.

Segment 1 of the outline includes those tasks necessary for performance by both employed and personal-use typists. Thus, there is no reason to have separate vocational and personal-use typewriting courses as all students can take the same course called Beginning Typewriting or Keyboarding. The first half of Segment 2 continues with a number of components necessary for personal-use and vocational typists as well. Students who complete the first half of Segment 2 (i.e., first semester in a traditional program) will have completed most of those activities required by personal-use typists. The second half of Segment 2 (or the beginning of semester 2 in a traditional program) begins to move the student in the direction of applying strictly vocational typewriting skills. Finally, Segment 3 includes almost totally vocational-use skills. A student who completes the first year (Segments 1-3) of typewriting instruction will have completed most of those activities necessary to be employed in an office typing position. Segment 4 includes items that do occur in the office but so infrequently as not to put a student at a serious disadvantage if these tasks have not been completed in the classroom. Segment 5 continues with items that are nonessential but still useful to know. (The typing of offset masters, spirit masters, and mimeograph stencils appears to be limited almost entirely to educational settings.) It then moves the students into a career exploration of a number of occupational settings in which typewriting may be used. The second half of Segment 5 moves the student into the increasingly important area of word processing and microcomputers, with a focus on machine transcription, language skills, and an orientation to word processing. Segment 6 continues the process of developing these skills.

A Suggested Outline for Typewriting Courses

SEGMENT 1

Students will:

Key copy requiring the learning of the alphabetic keyboard (2 weeks at most).

Key copy requiring the reviewing of the alphabetic keyboard and develop keyboarding skills (until a majority of students reach at least 25 gwpm).

Key copy requiring the learning of the numeric keyboard.

Recognize and use common proofreading symbols.

Type business and personal letters in modified block form (paragraphs not indented) from print, typed rough drafts, and handwritten rough drafts, and compose at the typewriter.

Type addresses on #6¾ and #10 envelopes, including ZIP codes and return addresses.

Type addresses on #6¾ and #10 envelopes, including ZIP codes and names typed above printed return addresses.

Type addresses on index cards from printed lists, typed rough draft lists, and handwritten lists.

Type one-page manuscripts or reports without footnotes from typed rough

draft and handwritten rough draft copy, using single spacing and double spacing, both with and without headings.

Proofread and make corrections using correction fluid on originals.

Proofread and make corrections using liftoff or "correctible" typewriter or backspace and strikeover on microcomputer or electronic typewriter.

Clean typewriter.

Change typewriter ribbon.

SEGMENT 2

Students will:

Type multiple-page manuscripts or reports **without footnotes** from typed rough draft and handwritten rough draft copy, using single spacing and double spacing, both with and without headings, including table of contents (with and without leaders), acknowledgments, bibliography, etc.: unbound, left bound, and right bound.

Type multiple-page manuscripts or reports **with footnotes on each page** from typed rough draft and handwritten rough draft copy, using single spacing and double spacing, both with and without headings, including table of contents (with and without leaders), acknowledgments, bibliography, etc.: unbound, left bound, and right bound.

Type multiple-page manuscripts or reports **with footnotes at the end** of the report or manuscript from typed rough draft and handwritten rough draft copy, using single spacing and double spacing, both with and without headings, including table of contents (with and without leaders), acknowledgments, bibliography, etc.: unbound, left bound and right bound.

Type job application form.

Type personal data sheet.

Type business letters in modified block form from handwritten rough drafts with reference initials.

Type business letters in full block form from print, typed rough drafts, and handwritten rough drafts with reference initials.

Type business letters using subject line.

Proofread and make corrections using correction tape/paper on originals.

Type interoffice memoranda on plain paper with appropriate headings from print, typed rough drafts, and handwritten rough drafts with reference initials.

Type interoffice memoranda on preprinted forms from print, typed rough drafts, and handwritten rough drafts with reference initials.

SEGMENT 3

Students will:

Type addresses for window envelopes.

Type business letters using attention line.

Type special notations on envelopes.

Type business letters using copy notations, enclosure notations, listed material, mailing notations, and multiple page headings.

Type business and personal letters with carbon copies.

Center typewritten material vertically and horizontally from prearranged print, unarranged print, and handwritten drafts using both approximation and exact methods.

Type tabular/columnar copy **without column headings** and without columnar rulings from prearranged print, unarranged print, and handwritten drafts using both approximation and exact methods.

Type tabular/columnar copy **with column headings** but without columnar rulings, from prearranged print, unarranged print, and handwritten drafts using both approximation and exact methods.

Type single copy and multiple copies, using carbon paper and carbonless paper, of business forms from typed rough drafts, handwritten rough drafts, and verbal instructions:

- bills of lading
- credit memoranda
- financial reports
- insurance forms
- invoices
- purchase orders
- purchase requisitions
- statements of account
- voucher checks
- vouchers

Type business letters in modified block and full block form while composing at the typewriter (in rough draft and in final form).

Type business letters in semiblock form (indented paragraphs) from print, typed rough drafts, handwritten rough drafts, and while composing at the typewriter/microcomputer.

Type interoffice memoranda on plain paper with appropriate headings and on preprinted forms while composing at the typewriter/microcomputer.

Type business letters using company name in closing, postscripts, quoted material, and special closings.

Type the following from typed rough drafts, handwritten rough drafts, and verbal instructions:

- address, file folder, file drawer labels
- form letters, form paragraphs, and fill-ins
- lists (e.g., mailing)
- summary of minutes of meetings or conferences
- meeting agendas
- daily work schedules
- personnel forms
- expense reports
- speed-reply letters and memos
- itineraries

SEGMENT 4

Students will:

Type business letters in semiblock, modified block, and full block form from verbal dictation at the typewriter/microcomputer.
Type interoffice memoranda on plain paper with appropriate headings and on preprinted forms from verbal dictation at the typewriter/microcomputer.
Type business and personal letters on special-sized stationery: executive, half-size, legal.
Type business and personal letters including statistical data in tabular form.
Type tabular/columnar copy with column headings and with columnar rulings from prearranged print, unarranged print, and handwritten drafts using exact methods.
Type tabular/columnar copy with column headings, braced headings, and columnar rulings from prearranged print, unarranged print, and handwritten drafts using exact methods.
Type the following from typed rough drafts and handwritten rough drafts:

- financial reports
- periodic summary reports (e.g. sales, production, machine utilization, etc.)
- legal documents
- payroll reports

Type from typed rough drafts and handwritten rough drafts, multiple page reports or manuscripts with columnar material.
Type special style business letters, including AMS style.
Type the following from typed rough drafts, handwritten rough drafts, and verbal instructions:

- telegrams, cablegrams, mailgrams
- postcards

SEGMENT 5

Students will:

Type offset masters, spirit masters, and mimeograph stencils.
Make corrections on offset masters, spirit masters, and mimeograph stencils.
Type material specific to an occupational placement, according to student interests:

- legal
- educational
- medical
- banks/financial institutions
- insurance
- technical fields
- government
- manufacturing
- etc.

Repeat all previous instruction, but from machine dictation.

Review of punctuation, spelling, vocabulary, grammar, number rules, word division rules, capitalization, abbreviation rules.
Become oriented to word processing, including text-editing typewriters and microcomputers, if available.

SEGMENT 6

Continue second half of Segment 5.

One major change from traditional typewriting instruction is that tabular material is not presented until Segment 3 because table typing appears infrequently as a task either for a personal-use or an employed typist. In fact, of the major items typed by personal-use typists, the typing of tables ranked eighth for all persons (Featheringham, 1965). Its highest ranking was sixth for teachers, compared with twelfth for homemakers. A reasonable argument could be put forth for their earlier inclusion based on the difficulty of, and thus the learning time required for, typing tables. Microcomputer and word processing operators can perform this task with the use of simple codes.

Consider, next, the large number of items included in the outline for Segments 1-3. It should be apparent that the textbook cannot be covered item-by-item if this outline is followed. Teachers will need to select carefully the activities their students will complete in the course. It is also evident that teachers must be aware of the need for transfer of learning from one activity to another so that students might generalize better from one learning activity to another. For example, during the first segment, students will have to be told that the only major difference between a business and a personal letter is that the return address is needed on the personal letter. Other minor differences, such as punctuation, typing of signature line, etc., might also need directions; but the more the student can look at only the differences, the more efficiently the student will acquire skill on both activities.

The inclusion of composition activities at the typewriter may require a change in the preparation of typewriting teachers so that they will be prepared to provide such instruction. Time constraints and existing student abilities may require such competencies to be developed in other courses, such as office procedures, business English, and so on.

With the advent of the automated office, instruction is being affected. Minnesota has published an extensive manual suggesting content (with objectives and activities) for a curriculum from elementary through postsecondary levels. The basic outline proposed by *Electronic keyboards for personal and business use* (1984) consists of eight blocks of content:

1. Keyboard and Microcomputer
   A. Operating the Keyboard
   B. Utilizing Computer Functions
   C. Operating the Microcomputer—Hardware
   D. Skill Development

2. Skill and Productivity Development
3. Beginning Microcomputer—Software Applications
   A. Using Software
   B. Using Editing Skills
   C. Practicing Applications
4. Text Editing and Formatting of Data
   A. Updating Vocabulary
   B. Operating Computer Peripherals
5. Intermediate Applications
   A. Creating Letters (Personal & Business) and Envelopes
   B. Creating One-Page Reports/Manuscripts
   C. Creating Practical Applications
   D. Using Other Intermediate Programs
6. Advanced Applications—A
   A. Creating Letters, Memoranda, Envelopes, Mailing Labels
   B. Creating Reports
   C. Creating Columnar Documents
   D. Creating Job Application Documents
7. Advanced Applications—B
   A. Practice Set
   B. School-Based Project
8. Word Processing Software

Methods of Instruction: How Do We Develop Keyboarding Skills?

This section will present a number of suggestions for introducing the keyboard based on the principles presented in the first section. A recommendation contrasting what should be happening in the classroom with what has traditionally taken place will be followed by a brief explanation.

1. DO teach the alphabetic keyboard as quickly as possible and in no more than ten hours.	DON'T prolong keyboard introduction for weeks on end.

How much time to spend in teaching the keyboard is a decision based in part on student maturity and ability. However, it would appear that the keyboard should be taught as quickly as possible so that students may move into keying real-life material as soon as possible. Only when the total keyboard has been taught will students be able to key material containing all of the sequences in the language. And only by keying these sequences will students develop the ability to key in chains. While instructional materials allot a different amount of time to alphabetic keyboard introduction, a

maximum of ten hours should be sufficient, followed by keyboard skill development. Then keyboard development should be left behind for the development of production typewriting skill. Gross speeds in the low 20s seem to be reasonable for students to be able to focus on production typewriting tasks without an inordinate amount of focus on keyboarding, thus allowing them to develop decision-making skills necessary for production typing (West, 1983).

2. DO use meaningful letter sequences in teaching the keyboard.	DON'T use nonsense sequences that do not appear in the language.

The goal of learning the keyboard consists not of learning 26 individual responses, but rather of learning the letters in combination with other letters as they appear in the language. Consider, for example, the "r" stroke. Students do not, in fact, learn how to strike "r," but instead they learn how to strike "r" in combination with other letters. Thus, we find such combinations as "er," "tr," "fr," "gr," "re," etc. Notice that finger movement to and from the "r" is different in each combination. Thus, students need to develop a wide repertoire of responses for a given stimulus. Speed in keyboarding occurs as students develop chains that can be produced as a single response rather than as individual letter responses. Thus, in order to type "gr" as a chain, "gr" must be practiced.

A nonsense sequence is a sequence that does not appear in the language. The sequence "fjf" does not contribute significantly to chaining because the "fj" and "jf" combinations, if they appear at all in the language, appear infrequently. Thus, meaningful letter sequences are more effective in keyboard introduction than are nonsense sequences.

3. DO introduce the keys in whatever order will permit the earliest use of words and sentences for practice.	DON'T use isolated letters, sequences, and words for practice longer than necessary.

Research has shown that, of the approaches studied, it does not matter what approach is used to teach the keyboard. A home-row approach, a skip-around approach, a strong-finger-first approach, or whatever, all produce similar results. What is important, however, is that the keyboard be introduced in such a way as to provide an opportunity for students to key sentences as early as possible. Keying sentences permits transfer of learning to later sequences, develops chains more quickly, and provides better motivation. If students at the end of the first day of class can key "It is I.", there is considerably more motivation than if they leave the classroom being able to type "its."

4. DO permit sight keying in the beginning, but encourage students to watch their copy as soon as they are able.	DON'T prohibit students from watching the keyboard, monitor, or typescript. Don't use masks, blank keyboards, tape on keyboards, etc.

The principles supporting sight keying in the beginning have already been presented. To review, students who have not yet developed kinesthetic responses cannot use them until they are developed. Students need contiguity between stimulus and response. They also need contiguity between response and reinforcement. Even expert typists use visual access to the keyboard. Thus, we cannot expect beginning students to do something that advanced typists are not able to do. For all of these reasons, we need to have sight access to the keyboard available to students at all times.

This does not mean that we simply ignore students who watch the keyboard. Students should be encouraged to keep their eyes on the copy as soon as they are able to do so. There is a major difference, however, between encouraging them not to watch the keyboard and prohibiting them from watching the keyboard.

One approach is to say, "As soon as possible, try to key that sentence without watching the keyboard." However, techniques which prohibit students from watching the keyboard are detrimental, rather than helpful, to learning. Thus, using typewriters with blank keyboards, putting tape on the keys to cover them, blindfolding students, taping a sheet of paper over the top of the typewriter so that the keys cannot be seen, etc., are all detrimental to learning. In addition, there appear to be few reasons for using keyboard charts. They are primarily useful only to point out the fingering of keys during keyboard learning. If the students can find the key more quickly by looking directly at the keyboard, contiguity is developed by looking at the keyboard and not at a chart. Looking at a chart simply becomes another mediator that needs to be short-circuited out of the response sequence.

The teacher needs to consider why students watch the keyboard. There are two possible explanations: either the students have developed a bad habit or they have not yet developed sufficient kinesthetic feedback. If the latter is the case, then the most effective technique to be used in the classroom is to provide the students with lots of practice so that chains can be developed and kinesthetic feedback strengthened. If the former is the case, then speed-forcing techniques are needed to break students of such habits. Drill materials are available for the implementation of such techniques.

Several speed-forcing techniques are available. Microcomputer software can be ideal for such drills. Two kinds of textbook drills are presented here, both of which use external pacing techniques and are familiar to many teachers. One useful drill is to use paragraphs marked for half-minute intervals (see Figure 1).

30 wpm—2-minute timing

The large stock show, to be held in the main exhibition hall, is to be
½
even bigger than the excellent show last year. It is estimated that
1
twelve thousand people will visit our city every day. I am interested
1½
in seeing that the city is all dressed up for this fine occasion, and so I
2
ask your help.

Figure 1. Paced paragraph (Hansen, 1968)

Each paragraph is developed for a given speed. Students key the speed that is appropriate for their skill attainment at the time. When each time interval is called, students are to be within five strokes of the marked spot on the copy. (Accuracy in calling time intervals is improved by dictating the time intervals and using a tape recording during the drill.) Thus, students are paced to be neither ahead nor behind at each feedback point. Students are also placed in a situation where response competition exists. Either they learn to keep their eyes on the copy and progress from one speed to the next; or, because they are keyboard watching, they are unable to progress. Such speed-forcing techniques can be effective in breaking watching habits.

Another useful drill, incorporating response competition effectively, is one that adds a few strokes to each line (see Figure 2).

	GWPM in 20"	60"
1. Only a few of the men were checked.	21	7
2. Neither of us can fix the foreign motor.	24	8
3. Adjust your speed to fit the different words.	27	9
4. Gaining speed is partly a question of saving time.	30	10

Figure 2. Response competition drill (Lessenberry, et al., 1977)

Here students are instructed to complete the sentence within the time allowed. After the time has elapsed, they are to return the carriage on the teacher's direction, "Return!" If students have completed the keying of that sentence in the time allowed, they go on to the next sentence. If they have not completed the sentence, then they repeat it. Again, students either keep their eyes on the copy and thus develop the speed to move to the next line, or they keep their eyes on the keyboard and probably do not progress. Such drills are also useful in developing return key skills.

Given these two types of drills, students with adequate motivation will usually develop appropriate copy-watching techniques. Teachers need to be reminded, however, that, because students do have different degrees of kinesthetic feedback, these drills may become effective sooner for some students than they will for others.

5. DO use vocalization to develop ballistic stroking.	DON'T use techniques that encourage "pushing" keys.

Appropriate stroking technique is the use of a ballistic stroke. Keyboarding teachers frequently talk of using sharp staccato strokes, of touching a hot potato, or a chicken pecking corn to try to help students visualize what is intended by ballistic stroking. Ballistic stroking means that the momentum of striking a key carries the key down and up again without having to maintain finger contact throughout and is important for all keyboards.

One way to develop ballistic stroking from the beginning is through the use of teacher and student vocalization. As a key is introduced, both students and teacher shout or "shout whisper" the key as it is struck. Thus, in typing "it," one would vocalize, "i, t, space; i, t, space." This has the effect of providing a response competition situation in which students cannot shout the letter "i" and, at the same time, push the key. But by shouting (or loudly whispering) the letter, they will smartly strike the letter that is called. A parallel might be trying to twiddle your thumbs in opposite directions. It is difficult to do two things of opposing natures. As vocalization is the last mediator to disappear, teachers can take advantage of it and use it to develop good ballistic stroking. In addition, vocalizing adds one more sense to the response, perhaps helping to "fix" the response during beginning stages of learning.

6. Except during the first few days of keyboard presentation, DO use extensive, rather than repetitive, practice and vocabulary.	DON'T use repetition of the same practice material, or focus on "common word" practice. If words are "common," they will appear often enough in ordinary prose.

The research findings (e.g., Mach, 1971; Weise, 1975) on the use of repetitive practice material present some inconsistencies. It seems, however, that extensive, rather than repetitive, practice is to be preferred. There may be several reasons for this. Motivationally, students may become bored when they repeat material more than once. Another factor may be that with the more extensive vocabulary students have more practice on which to develop chains, which leads to increased performance and proficiency, thus improving motivation once more. In addition, the broader the vocabulary, the greater the positive transfer to later performance requirements. The conflicting evidence finds that repetitive practice can be useful, and perhaps necessary, under timed conditions if students are striving to reach an objective and move to other material as the objective is met.

The practice of focusing on common words is difficult to support. If the words are indeed "common" words, then they will appear frequently in ordinary prose and thus will be chained more quickly than will other words.

7. DO focus first on the development of speed (with generous error limits), then accuracy (recognizing that there will be some decrease in speed).	DON'T focus first on accuracy development, then speed. Also, don't try to develop speed and accuracy at the same time.

This recommendation results from the fact that technique improves dramatically during the beginning stages of keyboarding. Focusing on accuracy at a time when technique is weak and is just developing simply requires students to refocus on accuracy as they increase their speed because different techniques and approaches are being used by them. Thus, the more efficient operation is to put the initial focus on speed; and then, once a sufficient degree of speed is developed to enable students to move into production work, the focus can be placed on accuracy (Du Frain, 1945).

It is also clear from the research that speed and accuracy should not be developed at the same time but that they need to be attended to separately (West, 1983).

8. DO focus on speed until substantial improvement has been made before shifting the focus to accuracy; and vice versa.	DON'T shift quickly back and forth between speed and accuracy practice.

Once students reach the point where attention is to be given to developing accuracy, they then need to spend time on **each** component of performance (speed and accuracy) until substantial improvement is made on that component. The concept of massing practice is applicable here and implies that two minutes spent on speed practice and then two minutes on accuracy practice, or even as much as ten minutes on each during a single class period, may simply detract from the efficiency of the practice of either. Students are better off reaching their speed goals before they shift their attention to accuracy, and vice versa.

9. DO improve accuracy by finding the "right" speed.	DON'T use perfect copy practice. Its effects may be harmful and at best are useless.
10. DO use speed-forcing techniques through pacing to develop **optimal** speed, to develop ballistic stroking, and to break any keyboard watching habit that may persist after several months.	DON'T push students to **maximum** stroking speed.

As difficult and as frustrating as it is for most teachers to accept, accuracy depends on keying at the right speed. Stroking errors occur at random. This fact accounts for the lack of value of error-analysis charts—and the myriad of other so-called accuracy drills which have been found so often to be ineffective. Because errors, with the exception of substitution errors, occur at random, keeping a record of specific errors made is not going to be useful to students. Such evidence also questions the rather common classroom technique of perfect copy practice. First, this practice encourages poor keyboarding techniques. Students may be so concerned with perfect copy and not making any errors that they become hesitant in their stroking. They will tend to push the keys instead of using ballistic strokes. Second, teachers often record the number of perfect lines that students key. If placed on a graph, this results in public display, providing negative motivation for those students who need positive motivation the most. If anything, perfect copy practice will be detrimental to student performance rather than useful.

If teachers are concerned about student accuracy, then they will provide students with an opportunity to key at their **optimal** speed (West, 1983). Try stroking one key for a few seconds and keep stroking faster and faster and faster until you are stroking as fast as you can. Notice what happens to your arm. Your wrist, your lower arm muscle, your upper arm muscle, your shoulders, and maybe even your back start to hurt. Students should not be keying at their fastest speed because tension develops when they do; tension leads to fatigue; fatigue leads to an increased number of errors. Thus, if teachers want their students to key at their top accuracy, they should help them find a speed at which they can key at this top accuracy. The drills outlined earlier (Figures 1 and 2) are both methods that can be useful in determining optimal speed.

One of the most frustrating elements of accuracy development is that one kind of error becomes more common as students become more expert. Such errors are caused by kinesthetic cues that lead to chaining. For example, when students key "singal" in place of "signal," they are probably doing so because they see the letters making up "ing"; "ing" is a common letter combination that is quickly chained, and so they automatically respond by keying "ing," thus leading to an error. Likewise, words that end in "in" are frequently keyed "ing" because of the frequency of this word ending. Beginning students have not yet developed such chains and therefore do not make such errors. Only advanced students who have developed such chains are subject to this kind of inaccuracy.

11. If accuracy drills must be used, DO try response differentiation drills (i.e., m-n, b-v, i-e, etc., emphasis) and immediate error correction.	DON'T use meaningless drill material (i.e., concentration drills, figure 8 drills, expert's drill, right-hand drills, balanced-hand drills, previews, etc.).

Almost all of the drill material that is traditionally used has been shown to be of little value. Thus, right-hand drills, left-hand drills, balanced-hand drills, concentration drills, figure 8 drills, expert's drill, previews, etc., are an inefficient use of the students' time (West, 1983).

A couple of drills might be useful but apparently have not yet been subjected to research for such determination. In the first drill, students are told that if they feel as if they have made an error, they are to immediately rekey the word as it should be keyed. Good microcomputer software will permit backspacing for immediate correction. The technique of immediate error correction is well-established in several fields. Notice that students are not told to proofread the material, but rather they are to rekey the word only if they feel that they have made an error. Perhaps by making the correct stroke immediately after making the incorrect stroke, accuracy will improve. As an interesting aside, research has found that kinesthetic feedback alone is only efficient at a 50 percent rate for experts and at a 20 percent rate for beginners in telling them that a mistake has been made (West, 1983). This may be one of the reasons why so many typists have proofreading errors. They feel as if they can tell when they have made a mistake, but they can't; thus, they don't bother proofreading and the mistake remains in their work. (In addition, proofreading is a difficult task.)

A second type of drill that might be useful in developing accuracy is one that deals with response differentiation. Students practice materials that are loaded with commonly substituted letters such as "m-n, b-v, i-e, r-t," etc. Such materials would be loaded with the commonly substituted letters. An example of such a drill might be: Our corporate headquarters sent us a poor economic forecast. (McLean, Davison, & Santos, 1984a). Such a drill might be useful in differentiating between the "r" and "t" responses. By being forced to differentiate between the letters commonly generalized, students may be able to differentiate more clearly in the future and thus decrease their substitution errors.

12. DO use drills loaded with special features at the time the feature is introduced, e.g., returns, tabulations, shift key, numbers, etc.	DON'T use special feature drills long after the feature has been introduced unless the student clearly needs remedial help on that feature.

If accuracy drills are not effective, are there any drills that are effective? A case can be made for the use of special feature drills, such as those focusing on the return key, tabulating, shift key, numbers and symbols, etc. For example, students can develop proficiency on the shift key by keying sentences loaded with proper names requiring frequent shift key operation (see Figure 3).

Clark, Loeb & Company have branches in New York, Chicago, and Los Angeles.
McCray's Television Shop will have a sale Wednesday, Thursday, and Friday.

Figure 3. Capitalization drill (West, 1977a)

Numbers are generally not well keyed, not only because they are the most difficult of reaches, but also because numbers are keyed infrequently. Thus, special feature drills may be necessary for those students who wish to develop proficiency at the number row. Efficient use of the tabulation key can be developed through the use of drills requiring students to use tabulations frequently. However, teachers must be cautioned that they should not use these drills beyond the point at which they are useful to students. Using return drills into the second year of typewriting, for example, is difficult to justify, certainly on a class basis, but they may be useful on a remedial basis for individual students.

13. DO use special feature drills at the beginning of class if such time is needed for the accomplishment of administrative tasks.	DON'T use more than a couple of minutes a day for "warmup." It adds nothing to student skill, and more than a few minutes can be detrimental.

The common practice of teachers entering the classroom and placing on the board comments such as, "Type Section 55A three times," may be more detrimental to student development than it is helpful. Parrish (1960) found that the use of more than three to five minutes of such "warmup" material caused students to perform more poorly on straight-copy timed writings than they would have performed without the warmup material. Less than that amount of time seems to have no beneficial effect, though it has no harmful effect, either. Thus, if it is necessary to have time in the beginning of class to get students settled or to accomplish certain administrative tasks, then that time should be used for the special feature drills outlined in principle 12, rather than in having students type warmup material without purpose. Unlike athletics, warmup in typing is not needed because: (a) it is not subject to interference from other nontyping activities, and (b) typing involves low-effort muscular movements of the sort the hands are involved in in ordinary daily activities (West, 1983).

14. DO establish goals for each activity. This is especially important if repetitive practice is used.	DON'T let students practice without goals established.
15. DO provide goals for individual students rather than for the group.	DON'T require all students in the class to be working for the same goal at the same time.

Students who know what is expected of them and are working toward that goal will be more highly motivated than will students without such goals, and they will thus be more likely to reach those goals. Principle 14 operates side by side with principle 15. Goals must be provided on an individual basis rather than on a group basis.

Thus, in Figures 1-3, some students may be working for speed development while other students will be working for accuracy development as they attempt to find their optimal speed. In Figures 2 and 3, the rules would need to change if students are working toward different objectives. After 20 seconds, for example, there would need to be a ten-second pause so that students working for accuracy could read their material to find any errors. The directions would then be, "If you are working for accuracy, proofread your material. If you finished the line and had no more than one error in the line, go on to the next line. If you didn't finish or if you had more than one error, repeat the line."

The EDL skill builder is an example of principle 15. This device is a filmstrip projector with a mask which reveals copy word-by-word or line-by-line at a set pace. It may be appropriate when used by individual students or by small groups of homogeneous students. However, it may be very inappropriate as a classroom technique because, at any one speed, only a small group of students may be working at a goal that is appropriate for them. Other students will be looking at material that is being displayed at a pace that is too slow or at a pace that is too fast, leading to boredom and frustration. Many hardware items on today's market for typewriting instruction are subject to this same limitation. Microcomputers, on the other hand, generally encourage the setting of individual goals.

16. DO develop rhythm by focusing on techniques that encourage the use of optimal speed.	DON'T use any techniques that encourage metronomic rhythm, except in the earliest minute or two of learning a new key (e.g., stroke-by-stroke pacing, music records, machines that move paper through the carriage at a constant speed, etc.).

Rhythm is desirable in keyboarding; however, rhythm that focuses on equal intervals between each stroke is not desirable. Such rhythm is called metronomic rhythm. Except in the very beginning stages of keyboarding, such rhythm should be avoided. As already indicated, the difference between an expert and a beginning typist has to do with the number of chains in the repertoire of each typist. (Incidentally, chains are not developed by encouraging students to think in letter groups or on a word or a phrase level. Such encouragement in textbooks is non-functional. Students develop chains because they develop kinesthetic feedback through practice, not

because of a conscious cognitive effort.) Thus, any technique that focuses on equal intervals between strokes destroys the opportunity for students to develop chains. Think of how the word "the" is keyed in contrast to the way in which you would key the word "xylophone." Obviously, these letter groups are not keyed the same way. Because "the" has been keyed so many times, it has become chained and is keyed as a single response. On the other hand, the "xyl" sequence in "xylophone" is keyed so seldom that, when it is encountered, it is keyed on a stroke-by-stroke basis. By having students key with metronomic rhythm, they are prevented from developing the kind of stroking that will make them expert typists. The best rhythm is the least metronomic.

Any technique that forces students to use stroke-by-stroke pacing should be avoided. That is why music recordings should not be used in the classroom. In addition, attachments on the carriage of the typewriter that move the carriage so that a piece of continuous roll paper passes through the typewriter at an even pace are based on a fallacious premise. When the typist is finished, a transparent sheet with a number of straight diagonal lines on it is placed over the typewriter to determine the speed at which the typist keyed and to determine where there are deviations from a straight line. One manual (Sharp, et al., 1970) suggests that, wherever the deviations appear, the student has some stroking difficulties that need to be addressed in remedial drills. In fact, if such an overlay is used, its most useful application may be to help the teacher and student see where such deviations exist to underscore where chaining is taking place. Again, however, remediation is questionable because practice is the only thing that is going to develop such chains; and such chains will create additional deviations from the straight line.

A number of other current techniques are also detrimental to the development of such chains. Many companies market tapes which pace the students stroke-by-stroke. Even if used on an individual basis to meet the individual needs of the students, the students are then carried for long periods of time on a stroke-by-stroke response basis, thus hindering the development of chains. The use of electronic wall charts that flash a letter at a given pace may violate both the principle of individual differences, if used in a classroom setting, and the process of developing the kind of rhythm necessary for high-level speed. Some microcomputer software provides students with feedback on the average delay time in keying each key. Providing such information is falsely based on the assumption that each key is an individual response and that the time intervals before striking each key are interpretable. Salthouse (1984) provides the average response rate for each key and highlights differences in response rates for keys depending on the letter combinations in which they occur. Thus, teachers need to be very cautious of using any technique that demands stroke-by-stroke response on the part of the student. Again, the best rhythms are the least metronomic.

Rhythm is desirable in keying but that rhythm is simply the kind that permits the achievement of optimal speed. For the student on a manual or a typebar electric typewriter, rhythm can be judged by the lack of key clashes. On other keyboards, the development of rhythm may be measured only by the proficiency developed by the students.

17. DO teach appropriate techniques.	DON'T grade for technique. Technique problems, if they are problems, will be reflected in the product.

Proper techniques are necessary and appropriate. Beginners need to be shown techniques, such as proper posture, proper hand position, proper foot placement, proper stroking techniques, and proper return techniques. However, there are two precautionary notes that should be understood. First, individual differences apply as much to the application of techniques as to other parts of the instructional program. Some people may be more comfortable with their feet in a different position from that which is generally taught as the appropriate foot position, and so on. Such individual differences need to be taken into account.

Some time ago, a teacher told the author of a situation related to a student transferred into his classroom who keyed with hands perfectly flat. The teacher spent many hours trying to get the student to change to the accepted appropriate technique. When the teacher came to the realization that the student was keying 110 gwpm with that "poor" technique, he decided, quite appropriately, that it was an individual technique which did not need to be altered, and the efforts to change the technique were abandoned.

Second, we need to be cautious about grading for technique. One of the problems with the use of technique grading sheets is the subjectivity of the observer, thus leading to unreliable reports of performance. Lack of reliability exists because motions are made too fast to observe reliably, and the motions are only minimally different from each other. If indeed technique problems are problems, they will be reflected in the product and will show up in evaluation in an indirect way. Students who refuse to use proper stroking technique will not develop high speed performance and will thus be downgraded on their straight-copy timings. Students who refuse to apply the most efficient methods of setting up problems for production typewriting will take longer than will students using the appropriate techniques and will thus be penalized in their grades. A product is objective. The observation of technique is subjective. Therefore, we should look to the resulting product as a fair and reliable method of evaluating technique. Grade the product, not the process.

Methods for Production: How Do We Develop Application Skills?

The objective of all typewriting instruction must be production. This is the activity that exists on the job and in personal use application. Straight-copy skills are of value in only two respects: for students to take employment tests and as a modest contributor to production speed.

Unfortunately, in spite of evidence that suggests that straight-copy performance is not a good predictor of production performance, companies continue to use straight-copy tests for purposes of selecting their employees. A personnel director of a major company in the Minneapolis/St. Paul area had commented on the fact that executives within the company continued to complain about the fact that their typists were unable to type the quality of work they desired even though the typists had met the criteria established by the straight-copy employment test. A graduate student questioned the relationship between straight-copy and production typewriting and contacted this personnel director to set up her own study to determine the validity of these conclusions. For a period of one month every available applicant was administered not only the regular straight-copy timed writing employment test but also was given a handwritten letter to be typed that was scored for completion time, uncorrected typographical errors, and form errors. The study found almost zero correlation for both speed and accuracy between the two types of tests. Yet, in spite of this evidence developed in its own personnel office, this company continues to use only a straight-copy typewriting employment test.

The research, summarized by McLean (1971), presents a wide range of correlations between straight-copy and production speed and accuracy depending on the stage of training, task, test material features, and test conditions. On the average, the results show that, beyond novice typists for whom speed correlations are very low, straight-copy speed correlates with production speed with an *r* of about .6, but that the correlation on accuracy between straight-copy and production typewriting is only about .3. This is accounted for by the fact that keyboarding is a minor part of production typewriting with the major component being taken up with decision-making and machine manipulation. In addition, students approach production typewriting with a different "mind set" than they do straight-copy tasks. Thus, the most important aspect of a typewriting course must be a concentration on production typewriting.

In addition, Crawford (1956) found that students who spend all the class period on production typewriting compared with students spending 15 minutes on straight-copy and the rest of the time on production typewriting are just as proficient in straight-copy skills and far more proficient in production skills. West's (1972) study showed similar results with no differences in straight-copy typewriting but with 50 percent higher production typewriting quality for those with minimal straight-copy drill work. Again,

this provides evidence that the major focus of a typewriting course should be on production typewriting.

This section will focus on some recommendations for improving the skill of production typists.

Do's and Don'ts for Production Typewriting

1. DO use sufficient practice material like that encountered in the real world (i.e., handwritten, typed drafts, composition) to develop competency.	DON'T use an inordinate amount of printed practice material beyond introductory lessons.

As determined earlier, transfer of learning requires that classroom activities match, as closely as possible, the activities of the real world. While typewriting textbooks are providing more such material, the teacher is still left with the problem of providing such material for students. There are several ways that this can be done fairly easily, but it does require that teachers feel free to deviate from word-by-word reliance upon the typewriting textbook.

First, teachers can have students handwrite projects from form letters received, company-distributed copies of model letters not covered by copyright, and so on, for duplication. Within a ten-minute period, the teacher will have 30 projects consisting of handwritten material that can be duplicated and distributed easily to the student typists. Students are likely to make mistakes in copying which will then provide an opportunity for students to deal with some language arts skills. In addition, they will be faced with the real world problem of looking for spelling mistakes, trying to decipher words from various types of writing, and making all decisions about placement and format.

Second, and perhaps even more realistic, teachers can take advantage of advisory committees or simply do a survey on their own in the community in which they live, asking businesses to keep the input material that they have provided for their typists over a period of approximately two weeks. A graduate student at the University of Minnesota undertook such a project and received such excellent cooperation from the businesses concerned that soon he had accumulated enough input material to last for several years of a typewriting class. This material can be selected in such a way as to provide a range of types of material for the students to type from, knowing that the stimulus is identical to that in the real world. Incidental career exploration among several industries can also occur.

Finally, teachers can supplement material provided in textbooks with locally prepared handwritten and edited copy.

2. DO use material matching the difficulty of that encountered in the real world, i.e., syllabic intensity = 1.66; stroke intensity = 6.1.	DON'T use material so much easier than that encountered in the real world that there is little transfer and true skill is overestimated.

Another component of transfer has to do with the difficulty of the material that is used. Typically, a syllabic intensity of 1.4 and a stroke intensity of 5.0 have been used. These indices have overestimated how well students have been prepared for the real world. One analysis of vocabulary level in business communications (West, 1968b) indicates that the syllabic intensity is 1.54 and the stroke intensity is 6.0. A more recent study (Ober, 1983) found the syllabic intensity to be 1.66 with a stroke intensity of 6.1. Remember, too, that these figures are averages, meaning that half of the material in the real world is more difficult than these figures; yet the teacher is challenged to find anything in the existing instructional materials that will even approach this level of difficulty. Thus, the teacher needs to be aware of providing students with material that will challenge them to this level of difficulty. Textbooks need to be examined from the point of view of the difficulty levels represented. Implementation of Principle 1 for production typewriting will also help to solve this problem since the material being brought into the classroom from the business world will indeed be "real" material. Even at the beginning stages of typewriting, Fendrick (1937) found that students typed better on medium difficulty than on low difficulty material.

One word of caution—some people have looked at these figures and have concluded that these new figures need to be used to figure students' speed by redefining a standard word. This is not at all true. Standards of five strokes to a word can still be used on material that is of actual stroke intensity of 6.1. By changing to some other standard, we underestimate the performance of our students as compared to other students whose skill has been measured by the five-stroke standard and who will also be interviewed by prospective employers. Thus, we need to maintain the standard counts but increase the difficulty of the material used.

3. DO provide guidance in beginning stages of any topic and confirmation beyond the beginning stages. Develop decision-making skills.	DON'T provide guidance (i.e., line length, spacing, number of words, etc.) beyond introductory lessons on any topic.

The need is to provide guidance in the beginning stages, with confirmation beyond the beginning stages of learning. The first few times a task is

typed, students may type from perfectly arranged copy. The next few times, they may type with explicit instructions. After that, however, it may be necessary to bypass typical typewriting textbooks as they do not generally provide the opportunity to type the vast amounts of material needed without guidance. By having students handwrite materials or by gathering materials from the business world or by selecting a textbook carefully, the teacher has no problem with providing sufficient material that does not have an inordinate amount of directions. By forcing students to make their own decisions, decision-making, which will be required after the student leaves the class, will be developed. But if the student is always told precisely how to perform the task, when will decision-making ever be developed? The teacher must also be aware of the need to provide confirmation following decision-making. Only in this way will the students know whether they have made a correct response and thus be reinforced.

4. DO teach only the essentials of complex items such as number rules, word division rules, etc., as well as the use of appropriate reference tools.	DON'T teach so much detail on things like number rules, word division rules, etc., that students remember none of it.

While there is little research to support this principle, it seems to be a logical one. Many components of typewriting do consist of complex rules. The recommendation here is that, rather than providing all students with such a long list of details that they will not remember anything, the teacher determine the two or three major components of each rule so that the student will be able to remember those rules. Again recognizing individual differences, the teacher may simply want to make allowances for those students who may never acquire skills in certain components of typewriting performance. For example, there may be students who simply don't have a good enough "word sense" ever to be able to divide words appropriately. Such students should be given directions not to worry about word division but to go to the next line, leaving a somewhat ragged right-hand margin. This ragged right-hand margin is more acceptable than incorrect word divisions. Ober (1982) determined that only three word division rules covered 99% of all occurrences of word divisions in business.

Likewise, the teacher has to ask the question of what makes a rule correct or incorrect. Voeltz (1975) was interested in defining the concept of mailability. She constructed a letter containing several errors which was then sent to executives, their secretaries, and business teachers. Respondents were to circle all errors which they felt would make the letter unmailable. There were many differences among the three groups, with the business teachers disagreeing frequently with the other two groups. In-

cluded in the letter was one reference to $76.00 and another reference to $21. Interestingly, the business teachers circled $76.00 as making the letter unmailable, while the executives and the secretaries circled $21 as making the letter unmailable. Without attempting to say which is, indeed, the correct response, we know that the reference books indicate that $21 is the desired response. What makes that the rule? Who makes the reference book the acceptable format?

The conclusion, then, is for the teacher to determine which rules are essential and to help the students learn where they can find answers when they need them but not to require that they memorize long lists of rules which will never be applied later.

5. DO drill on the individual parts of a production task.	DON'T insist that students work on the complete task from the beginning.

Typewriting teachers do not need convincing as to the need for drill in straight-copy skills. However, there seems to be less awareness of the need for drill on production tasks. If the student is going to acquire the kind of proficiency that is desired, production drill is necessary. For example, surveys of what is done on the job (e.g., Guffey & Erickson, 1981) indicate that eye judgment (34%) as well as exact placement is being used. If this is the case, then students need experience at developing eye judgment. An appropriate drill might be to have students insert the paper, estimate an inch and a half down, strike a period, take the paper out of the machine, slap a ruler on the paper to determine how accurate they were, put the paper in on the other side, and repeat this over and over again until they can consistently come fairly close to hitting an inch and a half without having to space down line by line. Likewise, moving from a dateline to an inside address can be practiced several times in order to permit students to perform those components of the task quickly and efficiently. Timing students on such drills will provide contiguity in developing production skills. When all of the individual parts, or cumulative parts, have been practiced and they are efficiently developed, then the whole can be put together to develop students' overall proficiency.

To identify areas in which such drill (and more adequate instruction) might be necessary, McLean, Kranz, & Magnuson (1980) classified and counted the errors made by the participants in McLean's (1971) earlier study. The results, summarized in Table 1, below, indicate major difficulties in centering (open to improvement through drill). At least with reference initials, the implication is that students have not been required previously to determine the need for their inclusion (the principle of guidance vs. confirmation).

Table 1

High-Frequency Form Errors in Letters and Tables
(in percentages of possible occurrences; items exceeding 25% included)

Letters	%
Omission of reference initials	82
Incorrect spacing between closing and signature (less than 3 or more than 6)	44
Incorrect typing line width	40
Vertically off center by more than 1 inch	35
Table in letter not centered horizontally	34
Incorrect spacing before ZIP code (1-3 spaces permitted)	29
Side margins differing by more than 1 inch	28
Tables	**%**
Braced heading off center	70
Table off center:	
Vertically by more than 1 line	70
Horizontally by more than 2 spaces	54
Unequal intercolumner spacing	51
Column headings not centered	48
More than 2 blank lines after table title	34
Table heading not centered horizontally	29
Lines within a column heading off center	27

6. DO time all production work.	DON'T let students work slowly.

Time is an important component in production typewriting, not only from the contiguity that it encourages, but also because it is a major criterion in evaluating student performance. When timing, the total task must be considered; it is not enough to time students when they are simply keystroking the problem, but they need to be timed from when the project is first given to them until they are finished. In this way, they develop proficiency in desk organization, in decision-making, and in machine manipulations, as well as in keystroking. In addition, by always being timed, students do not become "uptight" over the fact that they are being timed—they take it for granted as a necessary component of their program. Too, there is greater validity to timing students in an evaluation setting when they have been timed in a practice setting. Finally, working under timed conditions will develop greater speed at keyboarding, as well as increase proficiency in production typewriting.

7. DO use time scores in timing production work.	DON'T use work scores in timing production work.

A **time** score is a score that is determined by giving all students the same project and recording how long it takes them to complete that particular

project. For example, students would all be given the same letter with instructions to raise their hands when they consider the letter to be typed in mailable format. When they raise their hands, the time is recorded on the board, in a gradebook, on their papers, etc. A **work** score permits students to have the same amount of time in which to type as much as they can, thus holding whatever minimal fatigue factors may exist constant. For example, all students would have to stop typing after ten minutes, regardless of how far they had typed.

One problem with work scores is that some students may never get to finish a project. For example, if ten minutes are provided for a letter, then some students may never get to type the complimentary close. Where do they get the practice they need? How do they develop proficiency unless they are given an opportunity to finish that project? The teacher, in turn, never knows if remedial work is necessary because the slow students never get to type that particular aspect of the task. In addition, the use of a work score does not permit discrimination among students who finish before the time allowed. The student who can complete a letter in five minutes is certainly more proficient than a student who takes ten minutes to complete the same letter. A work score does not permit such a distinction to be made unless more work is available to students than even the best student can complete. But that requires the development of considerable materials on which students can be timed and a subjective evaluation by the teacher on the quantity and quality of the additional materials completed by the better students.

8. DO move constantly about the classroom identifying student errors and providing models for students as soon as the task is completed.	DON'T take home every paper to check.

This recommendation arises out of earlier comments in this Rapid Reader regarding the need for providing contiguity and reinforcement. Students need to know immediately whether they have done work correctly or incorrectly. Such reinforcement comes from verbal comments, distribution of model answers, use of the overhead projector, and so on.

9. DO be innovative and creative in meeting the needs of **your** students.	DON'T be a slave to the textbook.

This point should be self-evident—no textbook designed for a national market is going to meet the needs of all students in every situation. The teacher, then, needs to be creative in the classroom. Instead of taking papers home every night to check, the time that would ordinarily be used

for that purpose can be used to apply innovative approaches to the typewriting class.

10. DO use class time for typing.	DON'T waste class time talking any more than is absolutely necessary.

Perhaps this principle does not need to be stated for the experienced teacher, but for many inexperienced teachers it is a wise word of counsel. Time spent talking in the classroom is time that cannot be spent typewriting. In order to develop proficiency and to develop the kinesthetic cues that are necessary, students must be typing. Thus, talking time should be limited and typing time maximized in the classroom.

11. DO teach the students how to make eye judgment placements and provide practice.	DON'T require all placement to be exact.

As indicated earlier, eye judgment is becoming more and more an important part of the job for typists. Without having the opportunity to make eye judgments in the classroom, graduates are not going to be able to make them on the job. Thus, we need to provide students with a variety of classroom situations, some which require them to produce copy that is centered exactly, and others which permit use of eye judgment. Perhaps early experience at making exact responses will contribute to later skill at making eye judgments. Teach precision first, then estimation.

12. DO begin correcting keystroking errors when placement decisions are being made reasonably well by a majority of the class.	DON'T delay error correcting techniques beyond the point where students are able to make good placement decisions.

Error correcting techniques need to be taught to students. The time to do this is when most students have developed enough proficiency on placement that they are not overwhelmed by such decisions. The teacher will have to be the judge as to when the students have acquired a competency sufficient to make the teaching of correct techniques feasible. As indicated in the outline section of this Rapid Reader, it is necessary for the teacher to use as many of the major methods of correcting errors as possible. Status studies (e.g., Guffey & Erickson, 1981) indicate that lift-off devices (as on correctable typewriters), magnetic media using immediate backspace and strikeover (as on word processors and microcomputers), correction fluid, and paper tape correction are the most frequently used modes. Typewriting erasers are seldom encountered today except on multiple-copy forms. Students need to

learn how to apply each of these techniques, as well as to decide which technique should be used.

13. DO use massed practice in beginning stages and distribution of practice later.	DON'T, in any case, distribute practice in such small units as to be meaningless.

Again, practice in production typewriting should probably be massed in the beginning and spaced over time. Thus, when students first type letters, they may spend a week or more on letters. At later stages, they may come back and spend just a day or two on letters in order to review what they have covered in earlier stages.

Summary

The production typewriting component of a typewriting course is the most important aspect of the course. Without such application, students will never be able to use the skill that they have developed in a real setting. The amount of time devoted to production typewriting should overwhelm the amount of time spent on the development of keyboarding. Only in this way will the transfer from the classroom setting to personal use or vocational competence be maximized.

Individualization of Learning: How Do We Meet the Needs of EACH Student?

Individualization of learning carries many meanings. Some people immediately think of an array of slide projectors, film projectors, tape recorders, flashing lights, etc. Others conceive of individualization of instruction as a "road map" of page references in textbooks, enabling students to proceed through the textbook at their own pace. Others see individualization of instruction as a means whereby students can select the objectives that they wish to accomplish and not have to meet objectives established by somebody else.

Each of these components can have a role in the individualization of instruction in typewriting. The diagrams below are two possible ways of looking at typewriting instruction.

Figure 4 displays traditional typewriting instruction. In this setting, students all operate in the same amount of time, i.e., time is held constant. The student who is a fast learner is able to achieve competency in many areas, while the student who is a slow learner is able to achieve competency in only a few areas, i.e., competency varies with rate of student learning.

In an individualized model, such as that shown in Figure 5, the only thing that is held constant is competency. Students who are fast learners will be able to meet that level of competency in a very short time. Slow learners, on

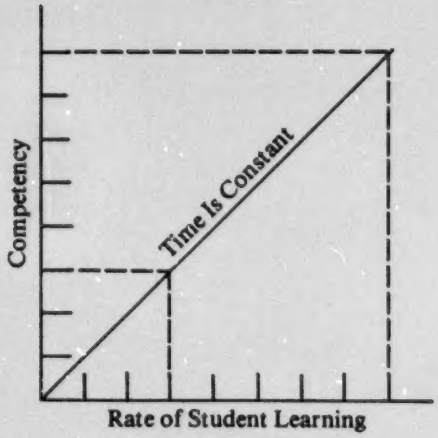

Figure 4. Traditional mode of instruction

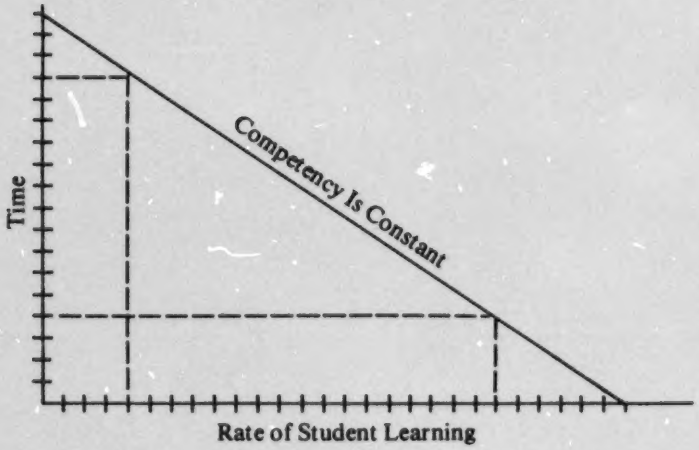

Figure 5. Individualized mode of instruction

the other hand, are given a much longer period of time to achieve that level of competency.

In the models presented, however, the assumption is still made that students will have the same competencies as goals. It may be more realistic to consider the needs of students in terms of both the amount and kind of competency desired and the amount of time needed to obtain that competency. For example, in a fully individualized program, one student may

identify the major objective of developing only basic keyboarding skills of 30 gwpm. Another student may wish to develop a speed of 50 gwpm and proficiency in the area of letter typing. The student who takes all year to achieve the goal of 30 gwpm might still receive a grade of A because that is the level of competency for the objective established but would receive only one quarter credit; whereas the student who achieved 50 gwpm and met the criteria for letter typing would also receive a grade of A but for three quarter credits. (For further details on this approach, see McLean, 1973.)

Degree of competency and length of time available are not the only ways in which we need to understand the individual needs of our students. As addressed many times earlier, in both the sections on keyboarding and production typing, there are various approaches that can be used to meet the individual needs of students. Group techniques and materials that keep all students together are detrimental to individual progress and should be avoided. Students should not be required to work on speed because everyone else in the class is doing so when their needs are to work on accuracy. While some students may need to be paced stroke by stroke for several minutes, others may need only a fraction of a minute. Some students may need to type 20 letters before developing proficiency, while others may require only three letters.

There are many materials available for students to use to progress on an individual basis. Not only are textbooks available, but there is also considerable focus today on such techniques as the use of job instruction sheets, programmed instruction materials, instructional packets (most of which are "homegrown"), slide/tape programs, microcomputer software, and so on. Unfortunately, only a few of these programs are comprehensive enough to provide all of the areas in which students need to acquire skill. In addition, the materials have not proven to be as useful as might be desired. This is especially true when a single type of approach replaces traditional instruction. Such an approach continues to ignore the concept of individual differences. Some students may do better in the traditional group setting. Thus, a considerable amount of supplementary material is needed, and more than one approach seems to be necessary within a class so that students can select the medium whereby they can most readily acquire a skill.

Providing such variety can become expensive for a school and may be out of the range of individual school systems. For many schools, individualization of instruction must come about through the creativeness and innovation of the individual teacher. Working together with other schools or working together as members of a department, teachers can develop supplementary materials so that the needs of students might better be met. Time for such development may come from providing immediate feedback to students in class rather than taking work home at night to correct. In addition, some released time, either during the school year or during the summer, may be necessary in order to put together a program that will be most effective for students.

There can be both advantages and disadvantages in using a system of individualized instruction. Following is a list of summary statements (modified from McLean, 1975) that might be useful in determining the extent of individualization desired in typewriting programs.

Possible Advantages of Individualized Programs

1. Greater specification of objectives
2. Greater care in sequencing of instruction
3. More intensive utilization of equipment
4. Greater opportunity for immediate feedback and reinforcement
5. Greater provision for diverse student interests
6. Encouragement of greater responsibility
7. Possibility for students to skip instructional topics
8. Removal of the teacher as the central focus
9. Greater opportunity for the teacher to work with the special needs of individual students
10. Greater opportunity to diagnose student learning difficulties
11. Instructional activities planned around home and work responsibilities
12. One-on-one competition for grades among students not necessary
13. On-going evaluation of the instruction
14. Continuous course offerings rather than periodic
15. Provision for different learning preferences or styles
16. Quality of instruction does not vary from one presentation to the next
17. Accountability for teachers can perhaps be built in easier than in traditional programs
18. Make-up work no longer a problem
19. Group support for discipline-problem students lacking, reducing classroom disruption
20. Greater variety possible
21. Teachers responsible for teaching larger number of students, reducing costs

Possible Disadvantages of Individualized Programs

1. Development costly and time consuming
2. Teachers assume counselor and curriculum development roles for which they may not have been prepared
3. Achievement in individualized classes varies widely from one program to another and may not be superior to instruction in a more traditional setting
4. External motivation reduced
5. Group activities more difficult to organize
6. Discussion of values and differing problem alternatives difficult
7. Integration of several skills often overlooked
8. Time to adjust needed by students

9. Average completion times vary widely and may be no different from group instruction
10. Instruction boring with the use of the same activities and procedures over and over or with the step-by-step approach used
11. Learning styles not provided for
12. Less contact with the teacher
13. Less social interaction with other students
14. Students procrastinate
15. Students may feel that there is more assembly-line regimentation, even though this may also occur in group instruction
16. Revision of content and procedures difficult when multiple copies of written materials must be changed
17. Individualization not the most effective teaching style for all teachers
18. Support lacking from other teachers, administrators, community, parents, or students
19. Revision of reporting procedures necessary
20. Overemphasis often given to reading
21. Extensive modification of commercially developed instructional packages may be needed
22. Shy students reluctant to get assistance
23. Teacher responsible for the content of several complete courses at one time
24. Teachers developing their own programs may be asked to identify minimum competencies without adequate information or background
25. Recordkeeping and paperwork increased
26. Equipment and materials needed to support such instruction may be costly

Summary

Perhaps the greatest challenge to typing teachers is to provide instructional approaches that will permit students to achieve at the maximum permitted by their abilities. Teachers cannot rely solely on commercial material at the present time to do this but will need to supplement so that students can choose their own objectives and the level of competency they wish to develop. In addition, with the continuing emphasis on teacher accountability, teachers are being challenged to provide for articulation from elementary to junior high to senior high to post-secondary schools. Such articulation will put even greater pressure on teachers to individualize programs so that students will not have to repeat competencies they already possess. The challenge is to find ways to do this with the best results for each student.

Grading: How Can We Grade Students Fairly and Accurately?

Before discussing specific grading techniques, it is necessary to distinguish between evaluation and grading. Evaluation must go on constantly within the classroom. In evaluation students receive feedback about the correctness of their responses. However, students should not be graded on their performance while learning a task but should be graded only on those activities that are performed at the terminal point, when a grade must be assigned. Thus, when students are learning to type letters, they should not be "graded" but should be constantly evaluated. However, at the end of the first grading period when a grade is to be assigned, then it is appropriate for students to be graded on their performance at that time. The point here is to keep grading and learning activities separate and, perhaps just as important, to understand that the grade that is assigned is for terminal performance rather than for intermediate performance. Do we really care, in terms of grade, how fast the student is keying after four or five weeks of instruction? What counts is proficiency upon completion of training. When grading is necessary for motivational purposes at other times, the weighting should be minimal so that the bulk of the grade is based on terminal performance.

Some questions related to grading are beyond the scope of this Rapid Reader. In competency-based programs, grades may not be required at all. Once students have met the minimum competencies stated, they simply move on to other competencies until all competencies for a program have been achieved.

Another question not addressed here is how to treat students who are classified as students with special needs. Such students are generally not required to meet the standards of other students but the standards specified in their IEPs (Individualized Education Programs). However, each school is likely to have its own policy related to such students.

Reliability and Validity

Grading cannot be discussed without considering two necessary components of any measurement instrument. For an instrument to be used it should have both reliability and validity. This is not an issue that can be argued; it is simple fact.

Reliability deals with the consistency of the measure. For example, if a student were to take a five-minute timed writing and take a rest, then take another five-minute timed writing, the student's scores should be identical if the instrument is perfectly reliable in measuring such performance, and if no learning took place during the first timing. The more the two scores deviate from being identical, the less reliable the instrument. Likewise, a student who scores the highest in the classroom on day one should also score the highest in the class a week later, if the skill being measured is reliable. The more this rank ordering becomes disrupted, the less reliable the test instrument.

An instrument to be valid must measure what is intended to be measured, **all** of what is intended to be measured, and nothing but what is intended to be measured. Reliability is a precondition for validity. Thus, we do not determine students' intelligence by measuring the circumference of their heads. We are not measuring what we intend to measure. Likewise, validity is violated by testing production typewriting proficiency with a test of letter-typing skill only when manuscripts and business forms have also been included in the course. **All** of what the student has performed has not been taken into account.

A common practice in typewriting classes that violates reliability is the procedure whereby each student's three best timings are selected from perhaps 20 or 30 such timings that have been taken. In order to get consistency we need to determine students' typical performances, not their atypical performances. By taking the best of several timings, we are not getting the students' typical performances, but we are getting atypical performances. This practice affects reliability; reliability affects validity. By diminishing reliability and validity, we have a test procedure that should not be used. By taking the student's median performance (i.e., middle score), atypically good and atypically poor performance is ignored, leaving typical performance on which a grade is to be based.

Another common practice in many classes is to include personality characteristics (cooperativeness, behavior, etc.) and attendance factors in grades. Such a practice may violate validity by including more than what should be measured by a typing grade. Employers and others viewing student grades in typewriting should expect that the grade reflect typewriting performance. While attendance and personality characteristics are important, they should be recorded in a way that keeps typewriting grades reflective of typewriting performance.

Another example of validity violation of this type is the practice of counting an error that students do not find twice as much as errors students find. It is important to develop proofreading skills, and student performance in proofreading should be recorded. Proofreading errors should be kept as separate scores, however, and not confused with typing errors. Students making typographical errors need different types of remediation than do students making proofreading errors. Keep them separate!

Thus, any approach used in grading typewriting must be examined from the point of view of whether it meets the conditions of providing for both reliability and validity. With this in mind, we will review some of the major methods used to grade keyboarding and production typewriting.

Grading of Keyboarding

The three most commonly used methods of scoring straight-copy timed writings include the error cut-off method, net words per minute (nwpm), and some method of looking at speed and accuracy separately. Each approach will be examined in turn.

Error Cut-Off. The error cut-off method of scoring has been presented as a method of simplifying the grading of straight-copy timed writings. This method provides an error limit beyond which material is not accepted. Thus, if there is an error allowance of five, everything on the timed writing counts up to the sixth error. Anything beyond that is ignored. It should be immediately obvious that this is not a valid method of scoring because it does not take into account **all** that the student has produced. Without a valid measure, we simply should not be using this approach.

There are additional problems, however. Consider, for example, two typists of equal ability, both of whom key 60 gwpm, both of whom make six errors. The difference between the two students, however, is that the first student makes the sixth error at the end of the second line and from that point on keys perfect copy. The second student makes the sixth error just as time is called. This is not an unrealistic possibility, given the fact that errors are randomly distributed. The student who made the sixth error just as time was called would receive 60 wpm using the error cut-off allowance of five errors. The student who made the sixth error at the end of the second line, in contrast, would be credited with 5 wpm. Looking at the two students' scores, it would be impossible to guess that the students were of equal ability. Error cut-off obviously results in unreliable data (West & McLean, 1968; Pullis, 1972) since it wrongly assumes consistent performance from segment to segment of a work period. Such scores could also exist for the same student on two different timings.

Further, the teacher does not have the kind of information available to determine what kind of remedial work would be necessary. Looking at a score of 5 wpm, one would immediately assume that what the student needs is speed practice. For the student keying 60 wpm, the assumption would be that accuracy practice may be necessary. In any case, such determination is not possible simply by looking at the scores obtained. Students are also aware of the inequities created by the error cut-off method, thus affecting morale and diminishing motivation on the part of the students.

Error cut-off scoring should be avoided because of the lack of reliability and validity (statistical data will be presented later) in this method and because of the detrimental impact of its use upon students.

Net Words Per Minute. Nwpm is a grading technique in which students are penalized ten words for each error made. A student who keys 300 words with 5 errors in 5 minutes would be penalized 50 words (5 errors × 10 words). The **net** wpm rate would be $\frac{300-50}{5} = 50$ nwpm as compared with $\frac{300}{5} = 60$ **gross** wpm. The assumption for this penalty is that since errors are not corrected students should be penalized so that whatever words would have been keyed during the time taken to correct the error are deducted from the student's performance. Thus, if the average length of time to correct an error is approximately 30 seconds (based on the fallacious assumption today that a typewriting eraser would be used), a penalty of 10 words is appropriate for that student who is keying 20 wpm. But consider its

impact on students keying faster or slower than this speed. Students keying slower than 20 wpm are penalized more than they should be given their performance rate. Students keying 14 wpm would be able to key seven words in 30 seconds, yet they are penalized 10 words like everyone else. On the other hand, students keying 30 wpm should be penalized 15 words but instead are penalized only 10.

With nwpm we also encounter the problem of logic. The student who is keying 20 gwpm and makes 11 errors, according to the nwpm procedure, would be credited with minus 2 nwpm. What is the logical meaning of this? It is obviously impossible to conceive of taking 2 wpm off the page. An additional problem with nwpm is the lack of information available to teachers for remediation. Consider two students, both of whom key 20 wpm. This could be the result of one student keying 20 gwpm without any errors and another student keying 60 gwpm with 20 errors. Obviously, one student needs speed development and the other student needs to work on accuracy. With composite scores, however, it is impossible to know what kind of practice individual students need.

Statistical data will be presented in the next section.

Gross Words Per Minute and Errors Considered Separately. A number of grading techniques look at the two components of keyboarding skill separately. One method simply provides a listing of the two with grades assigned to each, e.g., on a five-minute timing for errors, 0-3 = A; 4-7 = B; 8-12 = C; 13-20 = D; 21+ = F. The same procedure would be followed for gwpm.

Other approaches look at gwpm as one measure while accuracy, the other measure, is stated either in percent of accuracy or in percent of errors. Any of these approaches is supportable.

Statistical data supporting the use of each measure separately, in contrast to the error cut-off or nwpm approaches, were determined in a study conducted by West & McLean (1968). Two five-minute straight-copy timed writings were administered to students during the first, second, third, and fifth semesters of instruction to determine the reliability of various methods of scoring straight-copy timed writings. Each timing was scored in several different ways.

Using all students, reliability on gwpm was found to be .98, or almost perfect. On total errors the reliability was .69—a substantial reliability, but as expected, only half as reliable as gwpm (correlations must be squared before comparisons can be made). This error correlation is as high as it is because the timings were consecutive. With a lapse of a few days between timings, the correlation drops to about .40. The nwpm approach produced a reliability of .74, only slightly better than total error reliability and considerably less than gwpm. Under an error allowance of five across the four different semesters of training, the reliability of the error-cutoff method was .67, less even than the reliability for total errors alone. An error

allowance of four produced a reliability of .66; of three, .34; and of two, .36. In the case of an error allowance of two or three, reliability is only a tenth of what it is for gwpm.

The implications here are quite clear. To maximize reliability, use a separate score for gwpm and for errors. In addition, such recording of scores greatly increases the information available to both students and teacher for remediation. With gwpm and total errors separately recorded, it is easy to determine whether the student needs to focus on keyboarding speed or accuracy.

Evolving Grades from Separate Speed and Accuracy Scores. While recognizing the desirability of separate speed and error records, one must also be realistic in understanding that these must somehow be converted into a grade. Thus, this section will deal with a proposal for combining the two scores into a grade, while still underscoring the need for recording the two items separately in a grade book so that remediation might be provided.

Any method used to determine grades is somewhat arbitrary in that the concept of what a grade means varies considerably from school to school and from teacher to teacher. For purposes of this illustration, an average grade of B- was assumed. Teachers who wish to use C as the average may use the charts found in West (1983, pp. 380, 383). The charts which follow use a scale of 90-100 equals A, 80-89 equals B, 70-79 equals C, 60-69 equals D, and less than 60 equals F. West's charts were modified by assigning a B-, or an 80, to average or median performance. Robinson's (1967) normative data of student performance throughout the country at various points during the year were used originally to develop the charts.

a) Speed. Grades for speed are based on the average speed on two five-minute timings. Data suggest that Chart 1 could probably be used for two three-minute timings without drastically affecting the validity of the scales. Thus, for week 6 a grade of 80 would be assigned to a student keying 21 gwpm. At the end of 18 weeks of instruction, a grade of 80 would be assigned to a student keying 28 gwpm, and the average at the end of one year of instruction is 38 gwpm—the average level of performance of students at that stage of training.

b) Errors. Likewise, it was necessary to construct a chart for accuracy. This chart is based on Robinson's (1967) normative performance data of typists indicating that the average number of errors made on a five-minute timing is about 10, or two errors per minute (epm). Thus, whether students are in the sixth week of instruction or have completed a full year of instruction, they are still likely to make two epm on the average. While this seems high compared with student performance using either error cut-off or maximum number of errors methods, one must remember the earlier counsel that all timings must be used, not just students' best timings. Study after study has found that ten errors or more on a five-minute timing is the average.

Accuracy does improve in the second year of typewriting instruction but gets no better, on the average, than 5-7 errors on a five-minute timing. Accuracy improvement is even better than these figures might imply, for, as students become better typists, they key more strokes in five minutes; and, therefore, the percent of accuracy increases. However, the absolute number of errors remains the same beyond that period of time. Thus, on two five-minute timings, or on the equivalent of a ten-minute timing, the average first-year student will make 20 errors. Chart 2, then, assigns a grade of 100 to the typist with no errors and an 80 to the typist with 20 errors. For teachers who wish to use three-minute timings rather than five-minute timings, separate sets of grades for accuracy are shown. West (1983, p. 383) uses C as the average grade and determines error grades by establishing a maximum number of errors rather than assigning the average number of errors the average grade.

c) Combining Speed and Accuracy. The next question that must be addressed is: How are the two separate scores put together for a final grade? There are a number of ways of answering this question. First, one must look again at the relationship between keyboarding and production typewriting. Because the correlation between keyboarding and production speed is moderate, but low on accuracy, it is obvious that the most important component of keyboarding is speed. Speed should be given more emphasis in a grade than accuracy. How much more weight it should be given is not clear at the present time. In addition, one must consider the respective reliabilities of the two scores. Speed is at least twice and might be as much as three or four times as reliable as accuracy. Again, this evidence supports the need to give speed more weight than accuracy.

Finally, a teacher may wish to adjust the weights given to the individual components according to the objectives at a given point in time. A teacher may wish to give four or five times as much focus to speed as to accuracy in the first trimester since the intent is to focus on speed rather than accuracy in the beginning. In contrast, by the end of the year, the teacher may wish to give equal weight to the two components of the grade. However, one must also consider whether one wishes to give any weight at all to keyboarding skills by the end of the year; if so, perhaps the amount should be so minuscule as to make it almost meaningless.

Given these determinations and the decision on the part of the teacher as to how to weight the separate components, students may compute their overall grade or teachers may construct tables that would permit students to go directly from their performance to a grade. For example, if the decision has been made to give speed a weight of three and accuracy a weight of one, students would multiply their speed grade by 3, add their accuracy grade, and divide by 4 ($\frac{3S + 1A}{4}$). (This approach does have the problem of using a weighting scheme not based on the variability of the two measures involved.) Thus, during week six, a student typing an average of 21 gwpm (a grade of 80) with a total of 20 errors (a grade of 80) on two five-minute

Chart 1: Speed Grades

Average of Two Five-Minute Timings

GWPM	Weeks of Training (1st Semester)						
	6	8	10	12	14	16	18
6	60	60	58	56	57	55	54
7	61	61	59	58	58	57	55
8	63	63	60	59	59	58	57
9	64	64	61	60	60	59	58
10	65	65	63	61	61	60	59
11	67	66	64	63	62	61	60
12	68	68	65	64	64	62	61
13	69	69	66	65	65	64	62
14	71	70	68	66	66	65	64
15	72	71	69	68	67	66	65
16	73	73	70	69	68	67	66
17	75	74	71	70	69	68	67
18	76	75	73	71	71	69	68
19	77	76	74	73	72	71	69
20	79	78	75	74	73	72	71
21	80	79	76	75	74	73	72
22	81	80	78	76	75	74	73
23	83	81	79	78	76	75	74
24	84	83	80	79	78	76	75
25	85	84	81	80	79	78	76
26	87	85	83	81	80	79	78
27	88	86	84	83	81	80	79
28	89	88	85	84	82	81	80
29	91	89	86	85	84	82	81
30	92	90	88	86	85	84	82
31	93	91	89	88	86	85	84
32	95	93	90	89	87	86	85
33	96	94	91	90	88	87	86
34	97	95	93	91	89	88	87
35	99	96	94	93	91	89	88
36	100	98	95	94	92	91	89
37		99	96	95	93	92	91
38		100	98	96	94	93	92
39			99	98	95	94	93
40			100	99	96	95	94
41				100	98	96	95
42					99	98	96
43					100	99	98
44						100	99
45							100

Chart 1: Speed Grades (continued)

Average of Two Five-Minute Timings

GWPM	Weeks of Training (2nd Semester)								
	20	22	24	26	28	30	32	34	36
12	61	59	59	58	57	56	55	54	53
13	62	60	60	59	58	57	56	55	54
14	63	61	61	60	59	58	57	56	55
15	65	62	62	61	60	59	58	57	56
16	66	63	63	62	61	60	59	58	57
17	67	65	64	63	62	61	60	59	58
18	68	66	65	64	63	62	61	60	59
19	69	67	66	65	64	63	62	61	60
20	70	68	67	66	65	64	63	62	61
21	71	69	68	67	66	65	64	63	62
22	72	70	70	68	67	66	65	64	63
23	73	71	71	70	68	67	66	65	64
24	74	72	72	71	70	68	67	66	65
25	76	73	73	72	71	70	68	67	66
26	77	74	74	73	72	71	70	68	67
27	78	76	75	74	73	72	71	70	68
28	79	77	76	75	74	73	72	71	70
29	80	78	77	76	75	74	73	72	71
30	81	79	78	77	76	75	74	73	72
31	82	80	79	78	77	76	75	74	73
32	83	81	80	79	78	77	76	75	74
33	84	82	81	80	79	78	77	76	75
34	86	83	82	81	80	79	78	77	76
35	87	84	83	82	81	80	79	78	77
36	88	86	84	83	82	81	80	79	78
37	89	87	85	84	83	82	81	80	79
38	90	88	86	85	84	83	82	81	80
39	91	89	87	86	85	84	83	82	81
40	92	90	88	87	86	85	84	83	82
41	93	91	89	88	87	86	85	84	83
42	94	92	91	89	88	87	86	85	84
43	96	93	92	91	89	88	87	86	85
44	97	94	93	92	91	89	88	87	86
45	98	96	94	93	92	91	89	88	87
46	99	97	95	94	93	92	91	89	88
47	100	98	96	95	94	93	92	91	89
48		99	97	96	95	94	93	92	91
49		100	98	97	96	95	94	93	92
50			99	98	97	96	95	94	93
51			100	99	98	97	96	95	94
52				100	99	98	97	96	95
53					100	99	98	97	96
54						100	99	98	97
55							100	99	98
56								100	99
57									100

Chart 2: Accuracy Grades

Total Number of Errors

Two Three-Minute Timings		Two Five-Minute Timings	
Number of Errors	Grade	Number of Errors	Grade
0	100	0	100
1	98	1	99
2	97	2	98
3	95	3	97
4	93	4	96
5	92	5	95
6	90	6	94
7	88	7	93
8	87	8	92
9	85	9	91
10	83	10	90
11	82	11	89
12	80	12	88
13	78	13	87
14	77	14	86
15	75	15	85
16	73	16	84
17	72	17	83
18	70	18	82
19	68	19	81
20	67	20	80
21	65	21	79
22	63	22	78
23	62	23	77
24	60	24	76
		25	75
		26	74
		27	73
		28	72
		29	71
		30	70
		31	69
		32	68
		33	67
		34	66
		35	65
		36	64
		37	63
		38	62
		39	61
		40	60

timings would receive a grade of 80. While this might seem to be a very high number of errors allowed, it must be considered that all of the students' performance is being used at the terminal point of the grading period, thus assigning grades on the basis of average rather than atypical performance.

If a school uses a numeric scale that is different from the scale presented here, the scales can be adjusted easily by sliding the gwpm and errors up or down. In addition, the grades that have been developed have been based on performance of students in secondary school settings. It is not clear at this point what should be expected of students who perform at a level earlier than secondary schools (i.e., elementary or junior high school) or for those students at the postsecondary level.

One final word about evaluation of keyboarding relates to the question of differential grading within a classroom, i.e., "improvement" grades. As indicated in the first section on learning curves, students do acquire skill at different rates depending on their starting point. Students who begin at 20 wpm will progress to 30 wpm much more rapidly than students beginning at 70 wpm will progress to 80 wpm. Thus, if differential grading is used, the improvement required should be controlled so that students at higher rates do not have to improve as much as students at lower rates for equivalent grades.

There are additional questions that need to be raised about this practice, however. For purposes of articulation and contribution to a competency-based program, students who can already achieve at the level specified for "success" should not be **required** to go beyond that competency. If the requirement for graduation is 40 wpm, students who can already key 40 wpm upon entering the program should simply be waived from the requirement to improve their performance at keyboarding. To require that student to start working at 40 and move to 50 or 60 penalizes that student for having had earlier experience in keyboarding. Such a penalty is illogical, can be demoralizing, and has a negative effect on motivation in the classroom. Standards should be established that are acceptable for either vocational or personal use competency, and those standards should be required of all students. This does not imply that students cannot continue to improve and increase beyond the stated minimum competency, but it means that such improvement should occur because of the student's desire for such improvement rather than because it is mandated by a grade.

A further problem in grading straight-copy timings is faced by teachers who are using microcomputers or electronic typewriters in their instruction. By their nature keyboarding on this equipment is different from keyboarding on a typewriter. Because of the ease of correction, students approach the task with a different "mind set" and tend to key much more quickly. In addition, if errors are made, they can easily backspace, strike over, and continue, preventing (usually) the detection of original input errors. Thus, Charts 1 and 2 will not be accurate reflections of student performance.

Existing normative data on such equipment does not currently exist. Until it does, teachers have two options. The preferred is to gather data from large numbers of students in a given school or district to develop a local norm base. From this base grades can be determined as they were for Charts 1 and 2. If such a norm base is not possible, then teachers may need to make an arbitrary decision about anticipated performance and modify the charts based on that decision. For example, the decision may be made that only half as many errors will be permitted because of the correction option and that speeds 15% higher than those listed will be expected. Based on this author's personal experience, these figures appear to be tentatively appropriate. As normative data on microcomputers become available, alternative charts can then be developed.

Grading of Production Typewriting

As with keyboarding, there are many approaches that have been used in the grading of production tasks. Perhaps one of the most commonly used is production words a minute (pwam), a motivational process whereby a certain number of strokes is added for each machine manipulation with the intent of developing in the students the ability to type production work at the same rate as they keyboard. Others expect pwam rates to equal a set percent of straight-copy rates. The fallacy of this approach is apparent, however, in the McLean (1971) study where widely different performance occurred on the same class of task because of built in factors of difficulty. Also, as an illustration, for the specific production tasks used by Muhich (1967), approximately 50 percent of the time was spent in decision-making and about 12 percent in proofreading, with only 37 percent in keyboarding. If the letters had been doubled, obviously a greater length of time would have been spent in keyboarding and, perhaps, in proofreading. It simply is not reasonable to compare keyboarding with production skill.

In addition, research comparing performance on production tasks with keyboarding shows the magnitude of the difference between the two types of tasks. Rates of 5 wpm on tables and 15 to 20 wpm on letters are not at all unusual. Even adjusting these rates to pwam will not bring the two rates close together. Those who have been successful in bringing the two rates close together have generally ignored paper insertion, decision-making, etc., in timing the production typing. The technique used for evaluation in production typewriting should take into account everything a student does from the time a problem is presented until the student is able to present the task as a completed project. Pwam really does nothing to student grades, as a constant number of strokes is added to the work of all students. Thus, pwam leaves student rank in class unaffected. Finally, pwam appears to lack validity in how equivalent strokes have been assigned to the various machine manipulations. If equivalences have been developed through research, this author has been unable to locate such research.

Another frequently used approach is to assign a certain number of points to each problem and to take a point off for each error. This creates several

problems, both from a measurement and a logic point of view. From a measurement point of view, the problem is that when several items are put together on a test and each is graded according to a certain number of points the weighting that must be used must be based on the standard deviations on each of those tasks. By assigning an arbitrary total number of points to a task, we are unable to take into account the variations in difficulty that do exist.

From the logic point of view, the problem lies in determining the relative difficulties of individual tasks. McLean (1971) determined the relative difficulties of various components of letters, manuscripts, and tables. It was readily apparent that two items that looked to be of identical difficulty were not identical, as measured by student performance on those tasks. It was also not possible in that study to identify how much more difficult the insertion of a given component made a production task. Thus, a teacher cannot arbitrarily assign difficulty to a task. The only way such difficulty can be determined is through student performance.

The method that is proposed in this Rapid Reader is one that takes into account student range of performance and relative difficulty among materials. First, criteria to be used must be determined. There are at least three applicable criteria or indices of production typing proficiency: speed (and as indicated earlier this should be a time score or completion time), major errors, and minor errors. Considerable difficulty is encountered in determining what a major error and a minor error might be. It is not the prerogative of this author to tell teachers what a major and minor error might be, but it is strongly recommended that such distinctions be made clearly to students in the form of a list of criteria distributed prior to a student's undertaking production tasks. In this way, students know in advance how a task will be graded, and the teacher is more likely to grade reliably, knowing that students have a list of how each error is to be considered. Examples of such lists are provided in West (1983, pp. 394-5); McLean (1971, pp. 105-110); and McLean, Davison, & Santos (1984b, pp. 45-7).

Again, just as in keyboarding, what is important in production grading is not what occurs during practice sessions but what occurs at terminal points. Thus, during the last week or two before a grade must be given, students may take a production test designed to measure their performance. As soon as the test is finished, it is brought to the teacher's desk where the time is recorded directly on the paper. This author has found that recording to the nearest quarter-minute is sufficiently accurate, and, in fact, even recording to the nearest half-minute may be sufficient. If the test consists of more than one task and the teacher is interested only in the overall performance, then the student would complete all of the tasks before time is recorded. If the teacher wishes to keep separate times for each task, the second task is given to the student when the first task is completed. When that task is completed, the student brings it to the teacher's desk and the cumulative time is recorded. Later, if desired, the time for each individual task can be deter-

mined by subtracting the cumulative time for the first task from the cumulative time for the second task. If the test is given on three separate days, the time is recorded at the end of each day. The following day the student is permitted to put the paper back in the typewriter, or the disk back in the microcomputer, and then time is resumed.

For errors the teacher would simply score each of the production tasks using the criteria distributed earlier to the students and determine the number of minor and major errors made by each student. The teacher would then total each type of error for the given task or for the entire test.

Upon completion of the test, the teacher would rank order all of the completion times, from the fastest to the slowest. The fastest student would be assigned a grade of 100 on completion time; the average (median) student, using the rationale presented for keyboarding, would be assigned a grade of 80. Then, proportionate scores would be assigned for all other speeds.

Teachers are cautioned that, in a single class, the distribution may not be a normal distribution. In such a case, the procedure outlined may result in scores that are not desirable. However, speed typically distributes itself normally, even with a small number of students. Also, if a number of classes can be used or if a teacher can accumulate data from one year to another, normal distribution is likely to occur.

Let's assume, for example, that a letter has been assigned. The example that is presented here will be very artificial, just so the numbers can be kept small and easy to follow. The procedure that would actually be followed would be similar to this, but the number of students involved would be larger. Let's assume that the following distribution, in rank order, occurs for completion time.

Chart 3

Rank Order of Letter Completion Time

Student	Actual (in 1/4 minutes)	Grade
B	32	100
I	35	97
G	42	90
F	48	84
A	52	80
H	57	75
D	61	71
E	68	64
C	78	54

Having rank ordered the completion times, the completion time of the median student should be identified. With nine students, the median score would be that of the fifth student. Thus, the median student is student A, with 52 quarter minutes, and would be assigned the median grade which we

have already determined to be an 80. The student with the best performance (B) should be given a grade of 100. To determine intermediate grades, it is necessary to determine the number of points in numeric score that will be deducted for each quarter minute difference in completion time. To do this, take the difference between a perfect grade of 100 and the average grade of 80 and divide that difference by the difference between the fastest and the median completion time, e.g., ($\frac{100 - 80}{52 - 32} = \frac{20}{20} = 1$), which produces points per unit of time. Thus, for each possible quarter minute completion time, 1 point is deducted, leading to the grades indicated for completion time.

The great difficulty of assigning grades to quality scores is not easily overcome. Traditional approaches violate accepted measurement principles. Several options with their associated problems are presented.

One of the most often used methods of evaluating production typewriting quality is to deduct points from a predetermined number of points for a problem based on the seriousness of the error. The problem with this approach is the difficulty of determining how many points to assign to each task. How does the teacher know whether to give a problem 10 points or 40 points? Unless the variability or distribution of the scores is the same for each problem, measurement considerations prohibit the addition of those individual scores. Also, each error should be penalized proportionately to the total number of points assigned for that problem. An error that would penalize a student 1 point on a 10-point problem would need to penalize a student 4 points on a 40-point problem. This becomes a cumbersome task.

Another option is to assume a grade of 100 for a perfectly typed problem and deduct points for each error. For example, assuming students are penalized 2 points for major errors and 1 point for minor errors, a student would be penalized 6 points for a letter containing 2 major errors and 2 minor errors. (See West, 1983, Chapter 20, and West, 1975, for further details of these two approaches.) This approach does not solve the problem, however, as we have not been able to predict in advance the difficulty level of an individual production task although there have been attempts to do so (McLean, 1971). As a result, one task may have only a few penalty points deducted from the worst typist—not because the students typed so well, but because the task is so easy. On the other hand, a task could be extremely complex, and students could perform very well but still obtain low numeric grades because of the number of times points could be deducted. Compare, for example, the typing of a one-paragraph memorandum and a twelve-page manuscript. How can this system be used to reflect this difference accurately?

The fact that on some tasks there may be little variability (i.e., all students score 98 to 100) reduces the discrimination power of the test, a test characteristic desired by many people, but not by those who propose the use of a criterion-referenced, or competency-based, approach to evaluation.

A criterion-referenced approach may be based on the expectations of the business world and the assumption that employment requires perfection.

Yet, on "difficult" tasks, business would expect and accept some deviation from perfection from entry-level employees. Unfortunately, the research does not permit a determination of what quality level would be accepted in business.

Finally, a norm-referenced approach could be used, similar to that used for assigning production speed grades. In this approach, the student with the median number of error points would be assigned the median numeric grade, the student with the fewest number of error penalty points would be assigned a grade of 100, and other grades would be assigned on a proportionate basis.

Two problems exist with this approach. First, if the worst student makes only one or two errors, he or she will be unfairly penalized for only slight deviation from perfection. Second, a norm-referenced approach permits students with a number of errors to score high if most students made several more errors. On the other hand, if scores are widely distributed and a number of students were involved, this approach may be appropriate and may answer the problem of not being able to pre-establish the difficulty level of the task.

Regardless of which approach teachers choose to use, they are still faced with the problem of combining the speed and quality grades. As it is fairly widely accepted that quality is more important than speed for production typewriting, it is probably best, at present, to multiply the quality score by two (or three) and speed score by one to get a combined score, in spite of some measurement problems with this approach. What is needed is research to determine employment-related standards for specific tasks so that criterion-referenced standardized tests could be used for providing grades.

In spite of the difficulties outlined for each procedure, some approach must be used for assigning grades. Given the present "state of the art," the least disagreeable approach would assign greater weight to quality than to speed and would probably combine a norm-referenced approach to speed and a criterion-referenced approach to quality.

Combining Grades to Determine a Terminal Performance Grade

Once grades for keyboarding and production typewriting have been determined, there is still the difficulty of putting the grades together to determine an overall or terminal grade. The primary question to be raised here is the weights to assign to each component of the course. Validity requires that weights be assigned according to the importance of the content for the objectives of the course. Thus, it would be expected that keyboarding would carry more weight during the first trimester of a typewriting course or in a keyboarding course than in an advanced typewriting course. Conversely, production typewriting would assume increased weight as keyboarding emphasis declines.

In a beginning typewriting or keyboarding class, it would be reasonable to expect that 30-50 percent of the grade would be reflected in keystroking,

with the remaining 50-70 percent resulting from performance in production applications. As students progress to intermediate and advanced courses, the proportion of the terminal grade arising from keystroking would be expected to fall to 10 percent and then 5 percent. Such weights reflect the preponderance of applications content and recognize the lack of significant transfer of keystroking at this stage to business applications.

To this point no mention has been made of written exams. Written exams are designed to determine the cognitive knowledge students have about typewriting or machine manipulation. This author's preference is to have students complete application projects to determine not only their cognitive knowledge, but also their ability to apply that knowledge. The advantage of a written exam is that it can cover more material more quickly than can a production exam. If teachers prefer to use such exams, it is recommended that no more than 10% of the terminal grade be assigned to the results.

As indicated earlier, under no circumstances should techniques or superfluous considerations such as attitude or attendance be reflected directly in terminal grades. Such inclusion violates reliability and validity. These factors will be incorporated indirectly as they impact on student performance.

Thus, a first trimester terminal grade might be reflected in the following weights:

Straight-Copy Timings	30%
Personal Letters and Envelopes	20%
Business Letters and Envelopes with Proofreaders' Marks	20%
Reports with Headings and Proofreaders' Marks	30%

Summary

In evaluation, it is essential that valid and reliable techniques be used. Any techniques that violate either of these two procedures should immediately call into question the use of that particular approach. Thus, in keyboarding, the use of error cut-off and net words per minute measures should be avoided, and separate speed and accuracy measures should be used. In production work, normative data is to be preferred for speed measures. For quality measures, criterion-referenced standards are preferred, although problems do exist for their use.

Materials for Use in Instruction

A number of resources, both group and individual in focus, are available to assist the typewriting teacher. In addition to textbooks, many other instructional aids are currently available. These include slides, audio tapes, video tapes, films, overhead transparencies, microcomputer software, and so on. Not only are commercial publishers competing for sales, but a number of institutions that have developed their own materials are making them available.

Most teachers are experienced at selecting textbooks. Detailed checklists are provided by Crumbly & Copeland (1983) and Wood (1977-78) for selecting textbooks generally and by Robinson (1971) for typewriting textbooks specifically. Briefly, teachers should answer the following questions suggested by McLean (1981):

1. Does the content match your objectives for the course?
2. Is the material consistent with understood and accepted psychological principles?
3. What types of practice materials, activities, projects, questions, etc., are provided?
4. What are the physical characteristics of the material?
5. Is the reading level appropriate for your students?
6. What supplementary materials are available?
7. Is the material nonsexist and nonracist?
8. Are there sufficient illustrations and examples?
9. Is the material up-to-date?
10. What is the cost?
11. Is the material set up so that you can sequence the content as you wish?

Teachers have much less experience in selecting microcomputer software. In a project for TIES, McLean (1984) developed the following criteria for evaluating microcomputer software for keyboarding:

1. Keys should be introduced together with visual guidance on correct finger usage and technique for striking the keys.
2. Meaningful letter combinations should be used as soon as possible after introducing a key. Words, phrases, and sentences should be comprised of those letter/key combinations occurring most frequently in ordinary keyboarding use.
3. Natural error correction should be possible during drills.
4. Sound and sight should both be used to provide feedback about stroking accuracy.
5. Gross speeds reported should include all strokes made, correct and incorrect. Error correction backspaces may also reasonably be part of these rates.
6. Messages on success and judgments about quality of the speed or accuracy rate should be based on both individual learner progress and research-based error expectations at different rates.
7. Provision should be made within the program for upper- and lowercase letter display on the screen and the use of natural shift key operation for capital letters.
8. Provision should be made within the program for allowing computer-controlled interval timing while learners key from copy of their own choice—including composition—or their teacher's choice.
9. Emphasis should be on speed only in the beginning, with lenient accuracy standards, simply to prevent the inappropriate use of the

repeat key or the keying of "garbage." Later, emphasis on accuracy should be available. Each objective should be developed separately. The specific objective should be available at the choice of the student or the teacher. Thus, the three choices available should be feedback on: speed only, accuracy only, or both speed and accuracy.

10. The approach used should be appropriate to the developmental stage of the user.
11. Vocabulary use should be appropriate for the grade-level involved and should provide multiple options for individual differences.
12. A management system should be in place to maintain student performance records and to permit students to begin where they last stopped. Ideally, such a system would display student performance in graph format to identify performance trends quickly and easily.
13. The software should be able to accept a wide range of input speeds to at least 100 gwpm.
14. Periodic pacing should be in blocks rather than stroke-by-stroke to avoid metronomic rhythm, except in the very beginning.
15. Learners should be encouraged in initial stages to use direct visual access to the keyboard, with later encouragement and drills to wean users from such reliance.
16. Drills should use "regular" prose, rather than specially contrived materials. Teachers should have the capability to input their own materials.
17. Users should be able to escape a program at any time and return to the menu without having to reboot the system. Likewise, the menu should be detailed enough to permit numerous entry points into the program. The option to bypass individual screens should be available to teachers.
18. Motivation can be enhanced with techniques to encourage self-competition rather than competition with other students. Gaming formats must use *appropriate keyboarding techniques.*
19. Printing of student input material and performance, including the management system, should be possible, with teachers given the opportunity to indicate the slot in which the communications card has been placed.
20. Letter graphics must be clear so that letters are readily recognized, e.g., a and s are often difficult to distinguish on some existing software.
21. Most microcomputers use a wraparound approach. For positive transfer, beyond the lessons introducing the keyboard, options need to be provided for wraparound, "jump line," and use of the return key.
22. During introductory lessons, the screen should be kept relatively "clean." Only the line being typed should be displayed, along with the student input.
23. The program should be personalized, using the student's name,

animated graphics, and messages of positive reinforcement (though none of these approaches should be overdone).

24. Software should be standalone, i.e., it should not require print material support and should be self-instructional, not requiring teacher input, except for option selection and monitoring of the use of appropriate techniques.
25. The program should not be color dependent, as many schools will not have access to color monitors.

NOTE: Items 1-8 have been adapted from Lambrecht & Pullis (1983). Analyses of some of the existing microcomputer software are provided by Lambrecht & Pullis (1983) and Schmidt & Stewart (1983).

To include specific references for all of the material available would require a Rapid Reader by itself. The list (in the Appendix, pp. 67-68), therefore, includes only sources of such material. Because of the many noncommercial materials available, the list will obviously not be complete—but it is a start. The author would appreciate hearing of any additions or corrections that should be made in the list.

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Appendix

Textbooks

Anaheim Publishing Co.
2632 Saturn Street
Brea, CA 92621

Bobbs-Merrill Co. Inc.
A subsidiary of Howard W. Sams & Co.
4300 W. 62nd Street
Indianapolis, IN 46268

Crown Publishers Inc.
34 Englehard Avenue
Avenel, NJ 07001

Doubleday & Company Inc.
501 Franklin Ave.
Garden City, NY 11530

Forkner Publishing Co.
P.O. Box 978
Edison, NJ 08818

Glencoe Publishing Co.
17337 Ventura Boulevard
Encino, CA 91316

Gregg Division of McGraw-Hill Book Co.
1221 Avenue of the Americas
New York, NY 10020

Harcourt Brace Jovanovich
757 3rd Ave.
New York, New York 10017

Houghton Mifflin
One Beacon Street
Boston, MA 02108

Milady Publishing Corp.
3839 White Plains Road
Bronx, NY 10467

Science Research Associates (SRA)
155 North Wacker Drive
Chicago, IL 60606-1780

South-Western Publishing Co.
5101 Madison Road
Cincinnati, OH 45227

8 MM Films

Sterling Educational Films
241 E. 34th Street
New York, NY 10016

16 MM Films

Business Education Films
Division of Alden Films
7820 20th Ave.
Brooklyn, NY 11214

Coronet Films
65 E. South Water St.
Chicago, IL 60601

Sterling Educational Films
241 E. 34th Street
New York, NY 10016

35 MM Film Strips

Business Education Films
Division of Alden Films
7820 20th Ave.
Brooklyn, NY 11214

Encyclopedia Britannica
Educational Corp.
425 N. Michigan Ave.
Chicago, IL 60611

Gregg Division of McGraw-Hill Films
1221 Avenue of the Americas
New York, NY 10020

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